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INTEGRA MICROWAVE

MODEL TMF-1800K & M

TUNABLE MICROWAVE FILTER

OPERATION & SERVICE MANUAL

For serial #3034-301 or higher.

November 1983

WARRANTY

Integra warrants this instrument to be free from defects in material and workmanship for one year from the date of delivery. Damage due to accident, abuse, or improper operation, is not covered by the warranty. Removal, defacement, or alteration of any serial or inspection label, marking or seal, may void the warranty. Integra will repair or replace at its option, any components of this instrument which prove to be defective during the warranty period, provided the entire instrument is returned prepaid to Integra or its authorized service facility.

In-warranty instruments will be returned freight prepaid; out of warranty units will be returned freight collect. No other warranty other than the above warranty is expressed or implied. Integra is not liable for consequential damages.

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1.0 GENERAL INFORMATION

1.1 Introduction

The Model TMF-1800K & TMF-1800M TUNABLE MICROWAVE FILTER provides a new microwave design, measurement and production test capability not previously available in an instrument.

The TMF-1800K & M, TUNABLE MICROWAVE FILTER, is a WIDEBAND YIG FILTER which can be electronically tuned over the entire range of 2 to 26.5 GHz by means of a externally applied positive DC voltage. Two different drive sensitivity ranges are provided, .5 V/GHz (0 TO +13.25 V) or 1 V/GHz (0 TO +20 V), selectable at the rear panel.

The key to the TMF-1800K performance is a single-pole (Triple-pole for TMF-1800M) yttrium-iron-garnet (YIG) filter designed for maximum tuning range and maximum bandwidth. The 3 dB bandwidth is nominally 20 to 50 MHz over the 2 to 26.5 GHz frequency range; selectivity is 6 dB/octave; off resonance isolation is typically greater than 30 dB; insertion loss less than 4 dB. For the TMF-1800M, selectivity is 18 dB/octave; off resonance isolation is typically greater than 60 db and insertion loss is less than 8 db.

The selectivity of the Model TMF-1800K & M allows signal separation and analysis over much larger dynamic ranges than previously feasible. As a tuned postselector for microwave sweepers, synthesizers and signal generators, it can reduce harmonics and spurious output signals and extend the dynamic range of conventional swept or CW-measurements. It can reduce spurious signal outputs an additional 30 dB, improving most sweepers harmonic output levels to -55 to -70 dBc.

The TMF-1800K & M Control Unit provides controls for a variety of applications. For example, it can convert a comb generator output to a multi-octave signal source by selectively tuning each frequency; it can simplify intermodulation distortion measurements in amplifiers and converters; it can eliminate ambiquity in radio frequency interference (RFI) measurements. In RFI measurements, it replaces five individual octave band filters that are required for equal coverage.

1.3 Control Unit Specifications

Frequency Accuracy.....	0.1% ± 10 MHz
Frequency Resetability.....	<10 MHz
F1 - Control range see Table 1	
F2 - Control range see Table 2	
Filter tracks analog sweep speeds to 8 ms/GHz.	
Operationg Modes:	
CW or Sweep.....	Apply either a .5 V or 1 V/GHz analog voltage from signal generator to external input.
Temperature Range	10 to 50 degrees C
Control Unit Size (WxHxD)	8 1/2" x 5 1/4" x 17"
AC - Power	115/230 VAC, 50/60 Hz, 50 Watts max.

1.4 IEEE-488 Control Specification (Option 02)

COMMAND FORMAT: DDDDABC

"DDDD" = Frequency Selection Information

	OPTION-02
# of discret codes	65,536
Calculation Code	HEX
Lowest Code	0000
Highest Code	FFFF
Leading Zeros Req. In Code	Yes
Analog Output Range	0 to +10.000 V
Transmission Code	See Table 3

"A" = Positive Frequency Offset Selection
"A" = 1,3,5,7,9,B,D, or F = Offset ON
"A" = 0,2,4,6,8,A,C, or E = Offset OFF

"B" = Negative Frequency Offset Selection
"B" = 1,3,5,7,9,B,D, or F = Offset ON
"B" = 0,2,4,6,8,A,C, or E = Offset OFF

"C" = ANALOG Input Disable
"C" = 1,3,5,7,9,B,D, or F = Analog Input "OFF"
"C" = 0,2,4,6,8,A,C, or E = Analog Input "ON"

2.0 OPERATION

2.1 GENERAL

The TUNABLE MICROWAVE FILTER is a versatile, wide frequency range laboratory instrument that can conveniently separate or isolate signals on the basis of frequency. The Control Unit provides controls for precisely setting the start-stop frequency end-points, and adjustment for any drive voltage error (1 V/GHz or 0.5 V/GHz input). The RF-Head contains a yitrium-iron-garnet (YIG) filter that can be remotely located from the Control Unit.

2.2 FRONT PANEL FEATURES

FIG. 1 illustrates the front panel controls.

POWER: When AC power is applied to the instrument and the power switch depressed, the power indicator (GREEN LED) will be illuminated.

F1 & F2 FREQUENCY CONTROLS:

These controls are trim adjustments for removing any differences between the YIG filter start/stop frequency end points, and the external drive voltage (1 V/GHz) or (0.5 V/GHz)

REMOTE: When the instrument is under 488 control, the remote indicator will be illuminated (YELLOW LED).

2.3 REAR PANEL FEATURES

FIG. 2 illustrates the rear panel connections and controls.

AC POWER INPUT & FUSE HOLDER

For 115 VAC 50/60 Hz operation, use a 1A, Slow-Blow fuse. For 230 VAC operation, use a 1/2 A, Slow-Blow fuse.

FILTER CONNECTOR

This is the RF-Filter control output connector. Use only the control cable supplied with the instrument.

EXTERNAL DRIVE SELECT

Selector switch for 0.5 V/GHz or 1 V/GHz input drive sensitivity.

EXT. DRIVE INPUT

An external analog drive voltage of +1 to +13.25 V (in 0.5 V/GHz mode) sweeps the filter over the frequency range. The 1 V/GHz input can be used up to maximum +20 V (19.671 GHz).

DRIVE OUTPUT

A analog output voltage, proportional to the input drive is provided.

IEEE-488 BUS CONNECTOR (With Option-02)

A standard IEEE-488 Bus connector is provided for Bus Control.

ADDRESS SWITCH (With Option-02)

The address switch allows setting of the desired address for the IEEE-488 Bus control.

2.4 IEEE-488 Codes - for the TMF-1800H (Option-02)

The IEEE-488 control code is a combination of frequency selection information (DDDD) and mode control codes A, B and C.

CODE FORMAT: "DDDDABC"
(See Fig. 3)

Frequency Selection Information

Option-02 (65,536 Points of Resolution)

65,536 points of resolution are availabe with the HEX-CODES 0000 to FFFF and represents 0.40436 MHz/Code e.g.

8000 MHz requires:

$$\frac{8000 \text{ (MHz)}}{0.40436 \text{ (MHz/Code)}} = 19{,}784$$

(DECIMAL) 19,784 = HEX 4D48 = Transmission = "4=48"
NOTE: The HEX-code has to be translated to TRANSMISSION CODE Per Table 3.

Control Codes

A: POSITIVE FREQUENCY OFFSET

When "A" = 1,3,5,7,9,B,D, or F, then the positive frequency drive is selected. (Used for direct filter drive or for positive frequency offset). When "A" = 0,2,4,6,8,A,C, or E, then the drive is disabled.

B: NEGATIVE FREQUENCY OFFSET

When "B" = 1,3,5,7,9,B,D, or F, then the negative frequency offset is selected. (Used with the analog input drive signal to set-up a negative offset, lower frequency. When "B" = 0,2,4,6,8,A,C, or E, then the negative offset drive is disabled.

C: ANALOG INPUT DISABLE

When "C" = 1,3,5,7,9,B,D, or F, then the analog input drive voltage (1 V/GHz or 0.5 V/GHz) is disconnected. (Used when only IEEE-488 bus control is desired). When "C" = 0,2,4,6,8,A,C, or E,then the applied analog input voltage (1 V/GHz or 0.5 V/GHz) drives the YIG-filter.

Examples

1. Tune filter with IEEE-488 Bus to 9.000 GHz and disable analog input drive. Front panel controls of control unit to be inactive.

The set-up requires a few simple steps:

a) Set Dip switch S1-S5 to the open position (disconnect line voltage before removing top cover to set switches)!

b) Required frequency selection code is:

$$\frac{9000 \text{ (MHz)}}{0.40436 \text{ MHz/Code)}} = 22{,}257$$

Decimal = 22,257 = Hex X 66F1 = Transmission = "66?1"

c) The required control codes are:
A = "1" selects positive drive.
B = "0" disables negative offset.
C = "1" disables analog input drive.

d) To drive the unit with an HP-85 controller, the command would be:

```
10 OUTPUT 707; "66?1"
```

This assumes the IEEE-488 address has been set to 7 on the TMF-1800H control unit.

LISTEN ADDRESS CODE

In a 488 system, the TMF-1800K Option 02 functions as a listener. A listener is a device capable only of receiving data or commands from other insturments. The TMF-1800K is enabled as a listener when the controller transmits the correct listen address code. The TMF-1800K interface ignores all commands or addresses relating to talkers or controllers.

The seven-bit codes reserved for listen addresses and the corresponding ASCII character, are listed in Figure 4. (A total of 31 addresses are available). Bits one through five of the data (DIO) lines are set either high or low to select the address. The address code is set with five address switches 1 to 5 on the rear panel. (See Figure 2).

The nominal TMF-1800K listen address is ASCII Charater "07". The address may be changed by the system designer since the TMF-1800K does not require any particular address. When changing addresses, be sure the new address does not conflict with those of other instruments using the 488 Bus.

After changing the address, turn unit OFF and ON again to properly initialize the 488 card.

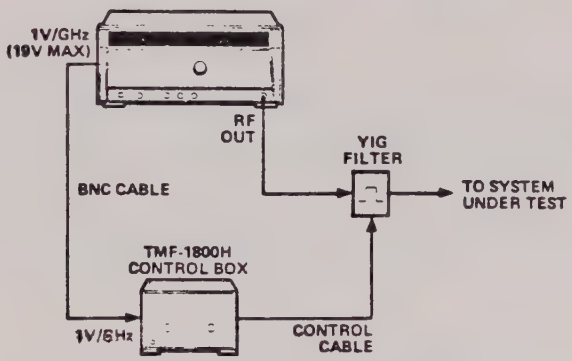
Address Switch Numbers					Address Characters		Octal Value	Decimal Value
5	4	3	2	1	Talk	Listen		
0	0	0	0	0	@	SP	00	00
0	0	0	0	1	A	!	01	01
0	0	0	1	0	B	"	02	02
0	0	0	1	1	C	#	03	03
0	0	1	0	0	D	$	04	04
0	0	1	0	1	E	%	05	05
0	0	1	1	0	F	&	06	06
0	0	1	1	1	G	'	07	07
0	1	0	0	0	H	(	10	08
0	1	0	0	1	I	)	11	09
0	1	0	1	0	J	*	12	10
0	1	0	1	1	K	+	13	11
0	1	1	0	0	L	,	14	12
0	1	1	0	1	M	-	15	13
0	1	1	1	0	N	.	16	14
0	1	1	1	1	O	/	17	15
1	0	0	0	0	P	0	20	16
1	0	0	0	1	Q	1	21	17
1	0	0	1	0	R	2	22	18
1	0	0	1	1	S	3	23	19
1	0	1	0	0	T	4	24	20
1	0	1	0	1	U	5	25	21
1	0	1	1	0	V	6	26	22
1	0	1	1	1	W	7	27	23
1	1	0	0	0	X	8	30	24
1	1	0	0	1	Y	9	31	25
1	1	0	1	0	Z	:	32	26
1	1	0	1	1	[	;	33	27
1	1	1	0	0	\	<	34	28
1	1	1	0	1	]	=	35	29
1	1	1	1	0	^	}	36	30
1	1	1	1	1	_	?	37	31

IEEE - 488 ADDRESS CODES

Fig.4

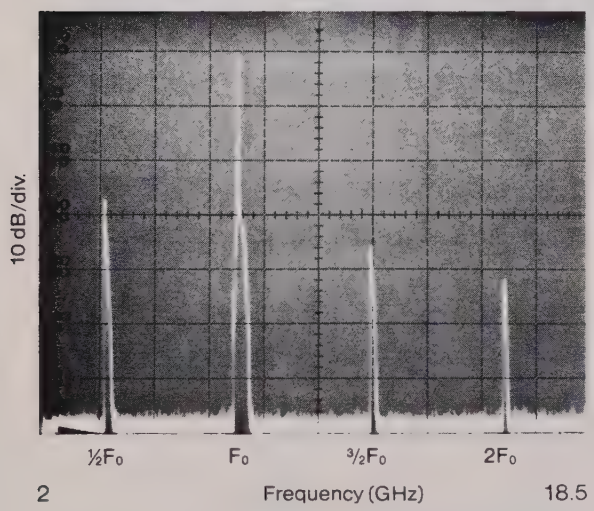
2.5 Typical Applications

2.5.1 Reduce Harmonics on Microwave Sweeper Output

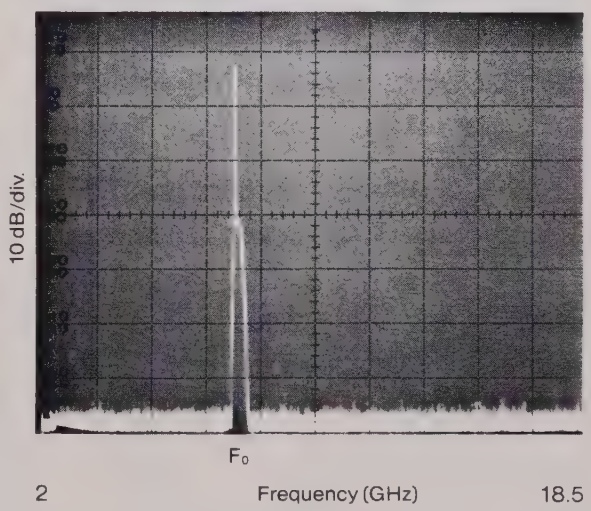


The INTEGRA Tunable Microwave Filter Model TMF-1800K can reduce harmonics and spurious output signals on Microwave Sweepers, synthesizers and signal generators by an additional 30 dB. This can improve most sweepers to a harmonic level of -55 to -70 dBc.

WITHOUT Tracking Filter



WITH Tracking Filter

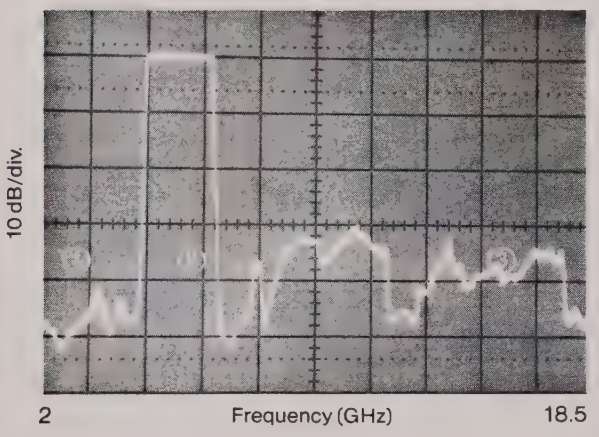


2.5.2 Microwave Filter Measurements

To measure off-resonance isolation (ORI) of a filter, over a wide frequency range, a very clean signal source is required. The dynamic range of the ORI measurement is limited by the Harmonic and Spurious output levels of the signal generator. Many signal sources contain harmonics that are only 25 to 30 dB below the carrier. The TMF-1800H is an Automatic Frequency Tracking Filter that reduces harmonics to a level of 50 to 60 dB below the carrier.

Exhibit A illustrates the effects of both subharmonic and high order harmonics on the ORI measurement of a 6.5 GHz bandpass filter. Exhibit B illustrates the true response of this filter.

EXHIBIT A



① Harmonic Response
② True Filter Response
③ Sub-Harmonic Response

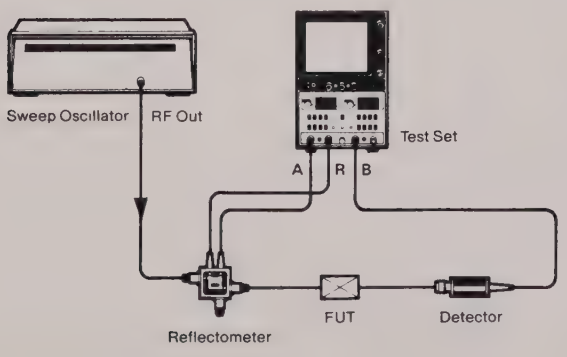
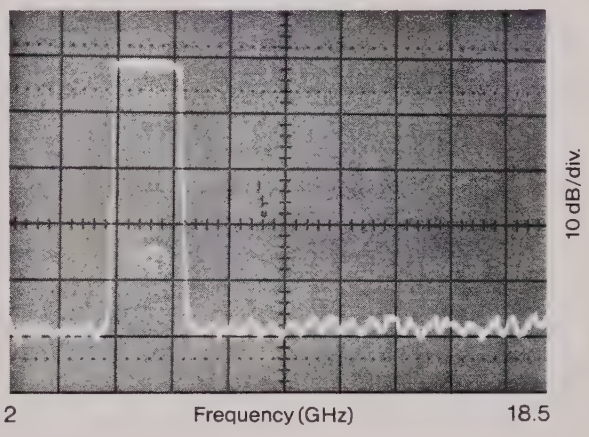
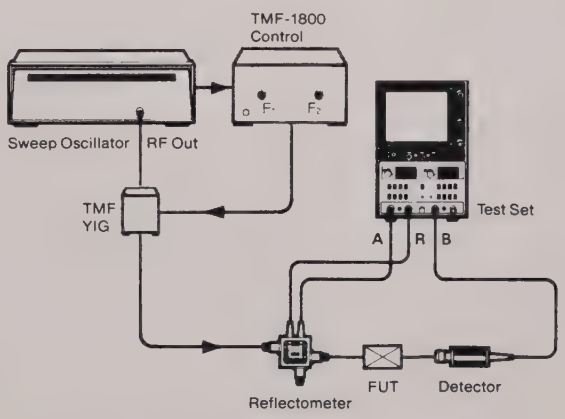


EXHIBIT B



② True Filter Response



2.5.3 HP 8340A/TMF-1800K - APPLICATIONS

Reducing HP 8673A Signal Generator Harmonically Related Spurious with the Integra TMF-1800K Tunable Microwave Filter

Introduction

Testing wideband receiving systems often requires microwave test signals with low harmonic and subharmonic spurious outputs. The HP 8673A Synthesized Signal Generator delivers microwave test signals over the 2 to 26.5 GHz frequency range with harmonic signals ($2f_O$, $3f_O$, $4f_O$, etc.) specified at least 40 dB down from a 0 dBm fundamental, and subharmonic signals and multiples thereof ($f_O/2$, $f_O/3$, $f_O/4$, $2f_O/3$, $3f_O/2$, etc.) specified at least 20 dB down. While this performance is more than adequate for band limited receiver tests, wideband receiver tests usually require better performance to prevent distortion and "false" responses. In testing electronic warfare surveillance or warning receivers, for example, harmonically related spurious outputs of the test stimulus can be detected and translated into false target indications.

The most straightforward way of dealing with harmonically related spurious is to reject the harmonics and subharmonics with filtering. Fixed filters are adequate in applications covering 0.7 octaves or so, but a number of fixed filters and a switching network are required to cover a broader frequency range. A more effective solution is a wideband tunable microwave filter that can automatically track the microwave test signal across its coverage range.

This product note describes the operation and performance of the HP 8673A Synthesized Signal Generator used with an Integra[1] TMF-1800K 2—26.5 GHz Tunable Microwave Filter.

The HP 8673A / Integra TMF-1800K System

The Integra TMF-1800K is one filter in a family of single stage, tunable, Yitrium-Iron-Garnet (YIG) filters providing typically 20 to 30 dB of off resonance isolation while introducing minimal insertion loss (see Appendix A). Figure 1 shows the frequency response of a typical TMF-1800K over its full coverage range with the filter tuned to 15.5 GHz. The filter's passband shape at 22 GHz is shown in Figure 2, revealing a typical 3 dB bandwidth of 45 MHz.

The TMF-1800K consists of a control box containing power supply and tuning circuits, and a separate YIG filter head. The SMA female RF INPUT connector on the filter head mates directly to the APC-3.5 male RF OUTPUT connector on the 8673A (see Figure 3). The filter is tuned via a 0.5V/GHz frequency reference voltage available at the FREQ REF jack on the rear panel of any 8673A with Option H36. Option H36 ensures that the frequency reference voltage will be of the appropriate sensitivity and linearity to accurately tune the filter to the 8673A center frequency. The FREQ REF jack on the 8673A Option H36 rear panel is connected to the EXT DRIVE INPUT on the TMF-1800K control box rear panel with a BNC cable as shown in Figure 4. The sensitivity switch on the control box rear panel is set to 0.5V/GHz.

For 2 to 18.5 GHz applications, the Integra TMF-1800C and TMF-1800H filters can be used with the HP 8673A or HP 8672A signal generators to improve harmonic and subharmonic performance over that fre-

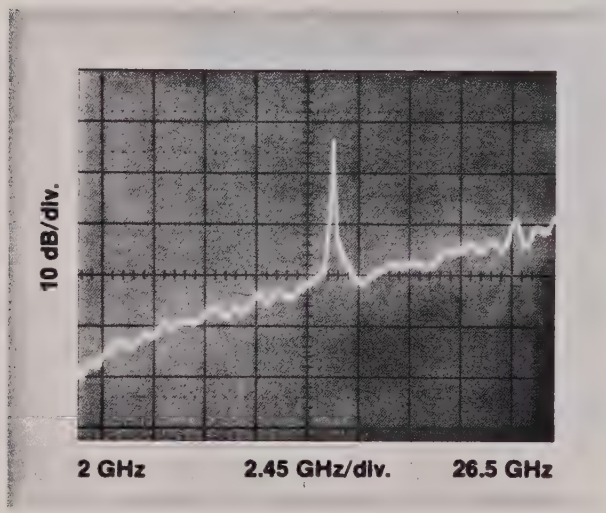


Figure 1. Integra TMF-1800K typical full band frequency response.

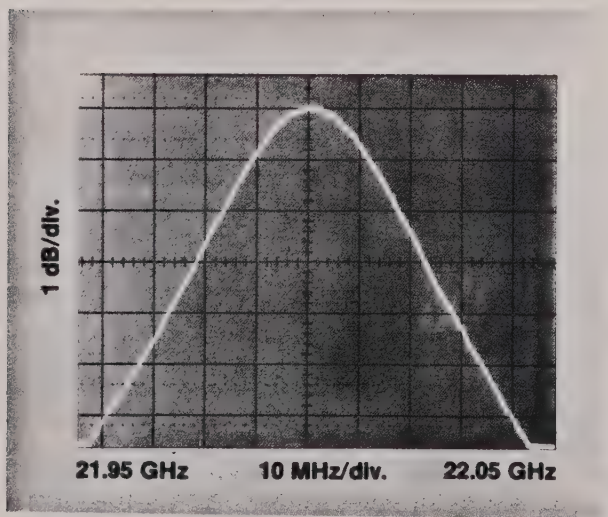


Figure 2. Integra TMF-1800K typical passband frequency response.

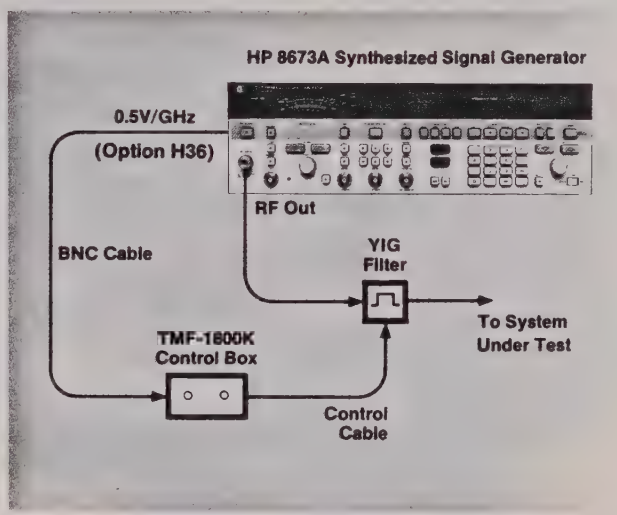


Figure 3. HP 8673A/Integra TMF-1800K system diagram.

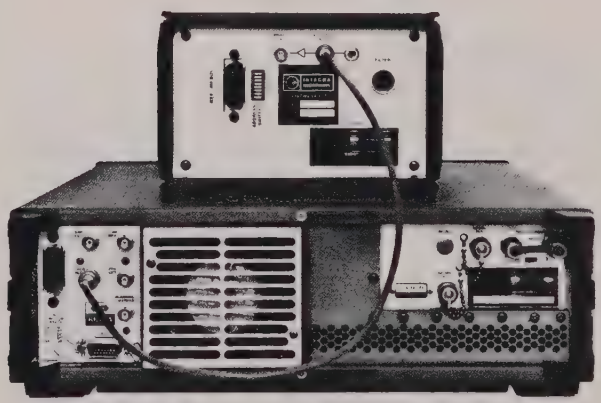


Figure 4. 0.5V/GHz tuning voltage rear panel interconnection (8673A with Option H36).

quency range (Figure 5). The TMF-1800C is tuned manually or by HP-IB[2] control (see Appendix B). The TMF-1800H is tuned by a 0.5V/GHz or 1V/GHz frequency reference voltage. Option H26 for the 8673A and 8672A provides the 1V/GHz reference voltage at the rear panel required by the TMF-1800H 1V/GHz sensitivity setting.

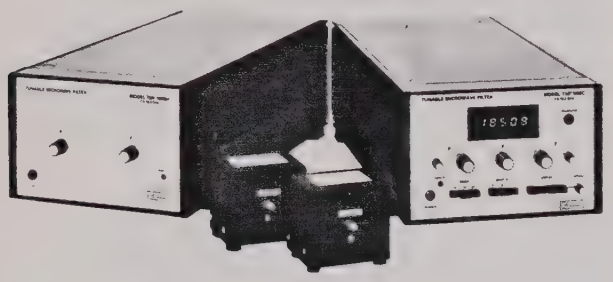


Figure 5. TMF-1800C and 1800H 2 — 18.5 GHz tunable microwave filters.

Filter Alignment Procedure

Before operating the 8673A/TMF-1800K system, the filter must be adjusted for optimum tuning alignment with the 0.5V/GHz reference voltage according to the following procedure.

1. Press [RCL] [0] (instrument preset) on the 8673A.
2. Connect the 8673A and the TMF-1800K in the configuration shown in Figure 3.
3. Set the output level from the 8673A to 0 dBm.
4. Set the 8673A output frequency to 2 GHz.
5. While monitoring the filtered RF output with a microwave spectrum analyzer, power meter, or diode detector and oscilloscope, adjust the F1 knob on the filter control box to achieve a point of maximum power (minimum filter insertion loss).
6. Set the 8673A output frequency to 26.5 GHz.
7. Adjust the F2 knob on the filter control box to achieve a point of maximum power (minimum filter insertion loss).

The filter is now aligned to a "best fit" tuning response for the 2 — 26.5 GHz HP 8673A coverage range. The TMF-1800K will automatically track the 8673A output frequency as it is set to any point across the band.

For applications requiring narrower frequency coverage in the 2 — 26.5 GHz range, steps 1 through 7 should be repeated to further enhance the filter tuning response, with the F1 and F2 points corresponding to the start and stop frequencies of the range of interest.

To counteract the effects of filter tuning hysteresis, it is good practice to always tune to the F1 frequency point before tuning to the desired frequency. This assures repeatability in tuning as the frequency is always approached from the same point on the hysteresis curve. This "intermediate tuning" step is readily accomplished under HP-IB control.

Typical Performance

The 8673A's performance largely determines the 8673A/TMF-1800K total system performance and flexibility. The 8673A external leveling capability can be used to obtain leveled output power from the signal generator/filter combination across the 2 — 26.5 GHz coverage range. Pulse and frequency modulation characteristics are affected by the limited filter bandwidth.

The performance detailed in the following sections is typical of an HP 8673A/Integra TMF-1800K synthesized signal generator system.

Spectral Purity

Figure 6 shows the reduced level of 8673A harmonic and subharmonic spurious. The filtered harmonically related spurious are typically <–55 dBc. The

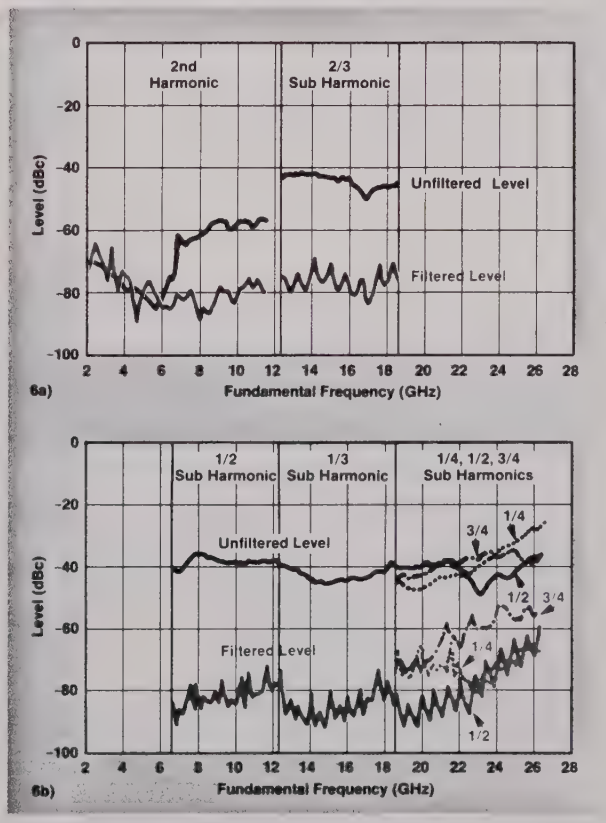


Figure 6. HP 8673A typical harmonically related spurious improvement with Integra TMF-1800K tunable filter.

most dramatic improvement is seen in the $f_O/4$ subharmonic which is reduced from a –25 dBc level at 26.5 GHz to –65 dBc (Figure 6b). Up to 18 GHz, the filtered harmonic and subharmonic levels are all typically <–70 dBc.

RF Output

Maximum Output Power

Figure 7 shows the typical 8673A/TMF-1800K maximum available output power. The TMF-1800K insertion loss is <4 dB to 26.5 GHz. The figure shows a typical worst case insertion loss plus tuning voltage variation power degradation of 6 dB at 24.5 GHz.

The 8673A has an AUTO PEAK subroutine which centers the internal YIG-tuned multiplier filter, assuring that the maximum output the instrument can deliver is being passed to the output connector. Correct operation of this routine requires that a stable load be present at the 8673A output. Therefore, disable the AUTO PEAK function via the front panel key or HP-IB before tuning to a new frequency. After the TMF-1800K has stabilized at the new frequency (approximately 20 ms/GHz switching time), the AUTO PEAK should be enabled to obtain the maximum available output power.

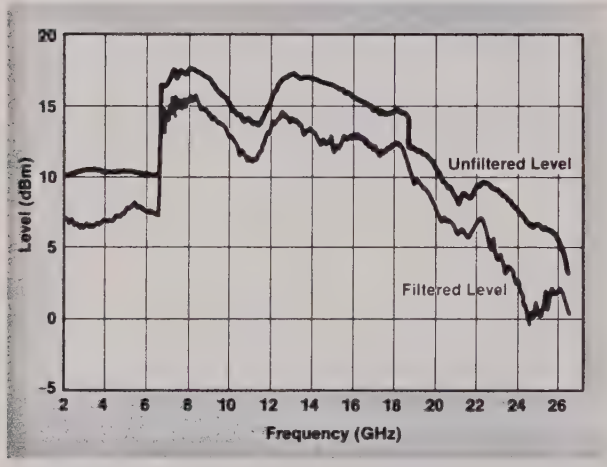


Figure 7. Typical HP 8673A maximum output power performance with and without the TMF-1800K tunable filter.

Because of mismatch between the 8673A and the filter (source and filter SWR's are typically <2:1), it may be necessary to insert a small pad between the source and the filter head to prevent the 8673A output from being pulled into acoustic mode oscillations below 6 GHz. The HP 8493C coax attenuator series offers 3, 6, and 10 dB pads ideal for this purpose. An alternative is lowering the 8673A internal power clamp level. This alternative is attractive because the power clamp only limits power up to the acoustic oscillation limit of 6 GHz, allowing full power to be available across the rest of the frequency range. See the 8673A Operating and Service Manual, Section V, for information regarding the Power Clamp Adjustment procedure.

Output Power Leveling

The external leveling capability of the 8673A can be used to compensate for the variation in output level caused by the filter insertion loss and tuning voltage variations. Figure 8 shows two possible 8673A/TMF-1800K external leveling configurations utilizing a crystal detector or a power meter. Krytar and Narda Microwave manufacture 2 — 26.5 GHz coaxial directional

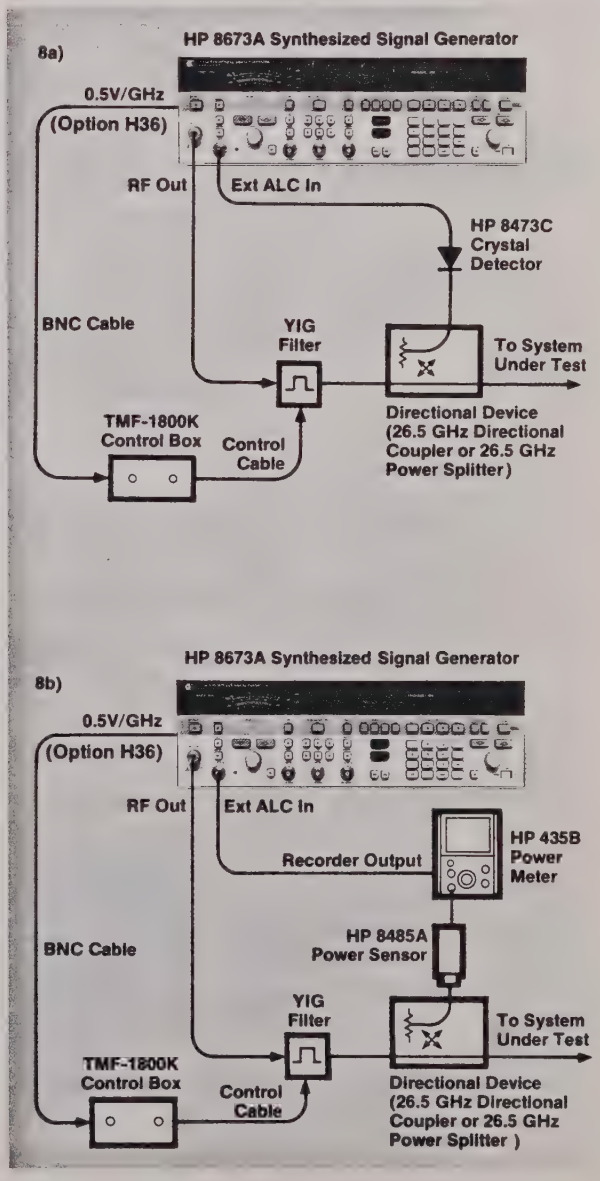


Figure 8. HP 8673A/TMF-1800K crystal detector and power meter external leveling configurations.

couplers that work well in these external leveling configurations. Figure 9 shows the leveling improvement obtained with the power meter leveling configuration shown in Figure 8b. Typical flatness of ±2 dB can be obtained with the crystal detector leveling configuration shown in Figure 8a.

When externally leveling the 8673A/TMF-1800K combination, maximum available output power is less than in the unleveled case because of directional device loss. The CAL control near the 8673A EXT ALC IN front panel jack allows convenient screwdriver adjustment of the external leveling loop gain. The CAL control can be used to calibrate the 8673A output level meter to indicate the power at the directional device output.

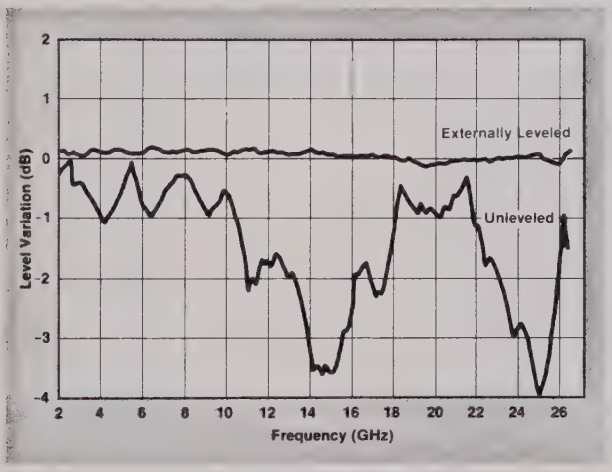


Figure 9. HP 8673A/TMF-1800K typical level flatness with and without external power meter leveling.

Switching Time

The TMF-1800K can track the 8673A output typically as fast as 20 ms/GHz. More time to reach a stable output level may be required in external leveling mode to give the external leveling loop time to settle. In digital sweep mode, a DWELL time of 40 ms or more should be entered on the 8673A to give the filter enough time to retrace before beginning the next sweep.

Modulation

The 8673A features amplitude, frequency, and pulse modulation of its microwave output via external modulating signal inputs. Amplitude modulation passes undistorted through the TMF-1800K provided the maximum RF input does not exceed the limiting compression level of the filter (+10 dBm specified). Frequency and pulse modulation are affected by the limited bandwidth of the filter.

Figure 10 shows the filter bandwidth reduction effect on 8673A FM in the frequency domain at a carrier frequency of 4 GHz. The FM sideband 14 MHz above the carrier is –16.8 dBc in the unfiltered case, but is attenuated to –21.8 dBc by the TMF-1800K filter skirt. This attenuation of FM sidebands by the filter will add distortion to the resultant 8673A FM signal.

Figure 11 shows the time domain effect of passing 8673A pulse modulated signals through the TMF-1800K. The filtering action increases pulse rise and fall times approximately 8 to 15 ns. The longer pulse rise and fall times are most significant at the frequencies

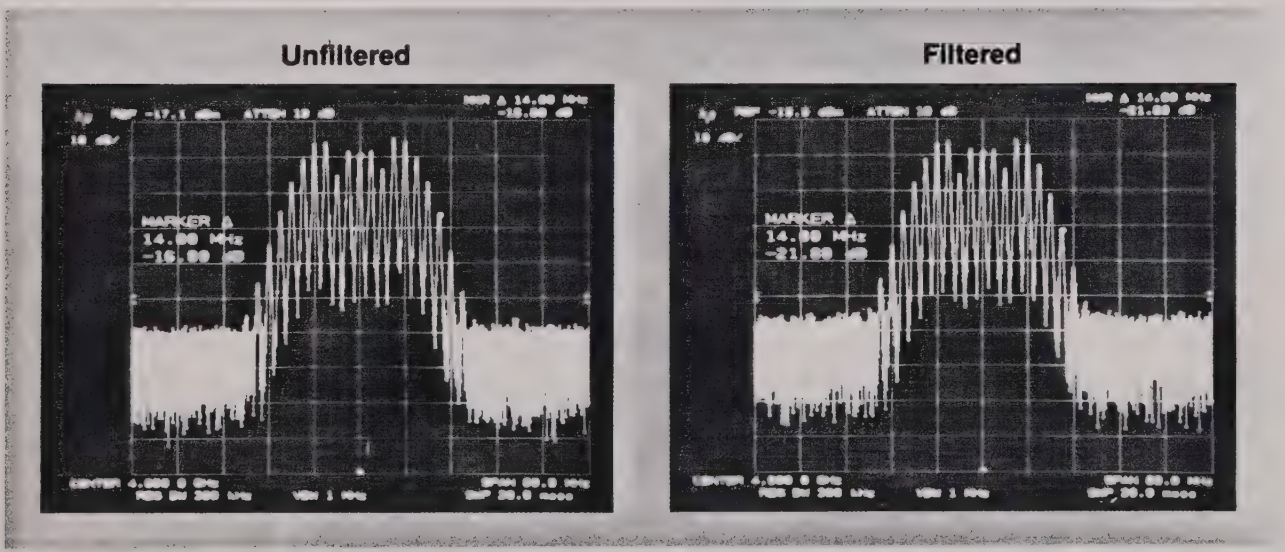


Figure 10. Typical TMF-1800K filter effect on 8673A FM performance (10 MHz peak deviation, 2 MHz rate).

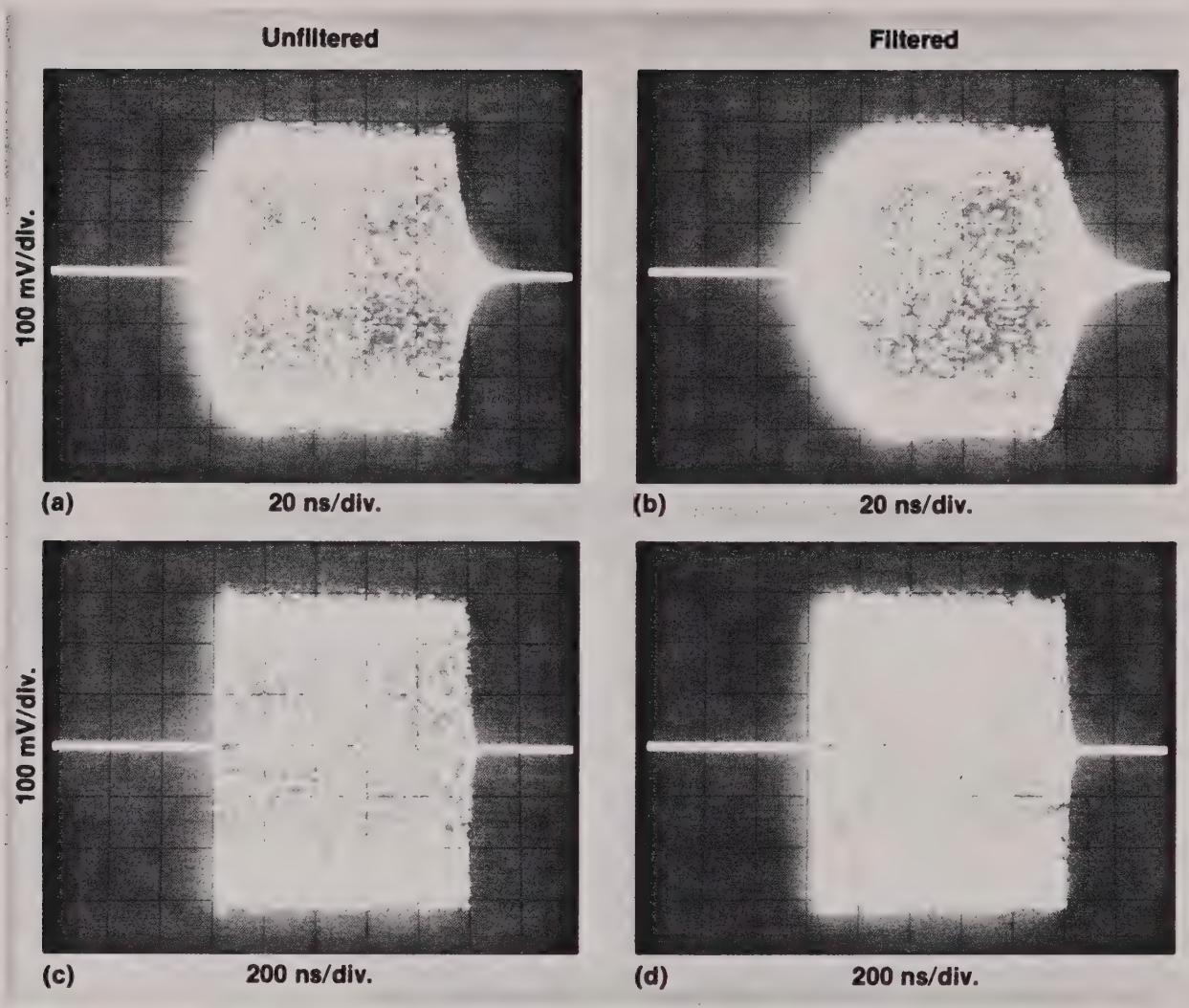


Figure 11. HP 8673A typical pulse modulation rise/fall time degradation with TMF-1800K.
(a) & (b): 9.4 GHz carrier; 100 ns pulse width.
(c) & (d): 2.7 GHz carrier; 1 μs pulse width.

where the filter exhibits its narrowest bandwidth (2 to 3 GHz; 3 dB bandwidth typically 20 to 30 MHz). For longer pulse widths, the degraded rise/fall times as a percentage of the total pulse width become negligible (see Figures 11c and 11d). The TMF-1800K filter causes no degradation in pulse overshoot or undershoot.

Summary

The HP 8673A/Integra TMF-1800K offers 2 — 26.5 GHz frequency coverage with harmonically related spurious outputs suppressed to at least <–55 dBc. The system is fully automatic with the filter being tuned by a 0.5V/GHz reference voltage from the 8673A Option H36. Output power degradation due to filter insertion loss and tuning voltage variations is kept to a minimum, and the 8673A external leveling capability may be used to maintain output flatness typically as good as ±1 dB across the band. Pulse and frequency modulation performance is limited by the filter bandwidth.

Other Integra tunable microwave filters are available for use with the HP 8673A and HP 8672A synthesizers to provide microwave test signals with low harmonically related spurious up to 18.5 GHz.

FOOTNOTES:

1. All inquiries regarding performance specifications, warranties, and ordering procedures for Integra Tunable Microwave Filters should be directed to Integra Microwave, 2368 Walsh Avenue, Santa Clara, CA 95051. Telephone (408) 727-9601 or TWX: 910-338-0585.

2. HP-IB is Hewlett-Packard's hardware, software, documentation, and support for IEEE-488 and IEC-625, worldwide standards for interfacing instruments.

Appendix A
Integra 1800 Series — Tunable Microwave Filters
Filter Specifications

Specification	Model Number		
	TMF-1800K	**TMF-1800H**	**TMF-1800C**
Number of Stages	1	1	1
Frequency Range	2—26.5 GHz	2—18.5 GHz	2—18.5 GHz
Tuning Mechanism	0.5 or 1V/GHz Analog Reference Voltage (IEEE-488 Optional)	0.5 or 1V/GHz Analog Reference Voltage (IEEE-488 Optional)	IEEE-488 or 0 to +10V Analog Reference Voltage
3 dB Bandwidth	15—70 MHz	15—70 MHz	15—70 MHz
Max. Insertion Loss	4 dB	3 dB	3 dB
Off Resonance Isolation	30 dB, 2—12 GHz 24 dB, 12—18 GHz 17 dB, 18—26.5 GHz	30 dB, 2—16 GHz 27 dB, 16—18.5 GHz	30 dB, 2—16 GHz 27 dB, 16—18.5 GHz
Limiting Level (min.)	+10 dBm	+10 dBm	+10 dBm
Selectivity (nom.)	6 dB/octave	6 dB/octave	6 dB/octave
VSWR (typ.)	2:1	2:1	2:1
Impedance (nom.)	50 ohms	50 ohms	50 ohms
Hysteresis (max.)	20 MHz	20 MHz	20 MHz
Max. Input Power	+30 dBm	+30 dBm	+30 dBm
Connectors	SMA female	SMA female	SMA female
Filter Head Size (WxHxL)	3.5" x 3" x 3.25"	3.5" x 3" x 3.25"	3.5" x 3" x 3.25"
Specifications subject to change without notice.			

Appendix B

CW Mode HP-IB Control of the Integra TMF-1800C Tunable Microwave Filter

The following BASIC subroutine can be used to control the Integra TMF-1800C using an HP 85, HP 9826A, or HP 9836A Desktop Computer. The subroutine assumes the desired CW frequency has been entered into variable F0, and the TMF-1800C is set to an HP-IB address of 705. Refer to the Integra TMF-1800C Operating and Service Manual for additional programming information.

```
100  ! HP-IB Control of the TMF-1800C CW Frequency Setting
110  F1=2                          ! Initialize filter limits.
120  F2=18.5
130  P=INT((F0-F1)/(F2-F1)*9999)   ! Calculate which frequency code is required (0000-
                                   9999 range) for desired F0.
140  P=(P+10000)*1000+10           ! Combine band limit and filter capacitor information.
150  P$=VAL$(P)                    ! Create output command string.
160  P$=P$[2, 8]
170  OUTPUT 705; P$                ! Output command string to filter.
180  RETURN
```

The CW subroutine programming time is approximately 60 ms to tune from 2 to 18.5 GHz, and 80 ms to tune from 18.5 to 2 GHz. The programming time includes the HP-IB response time.

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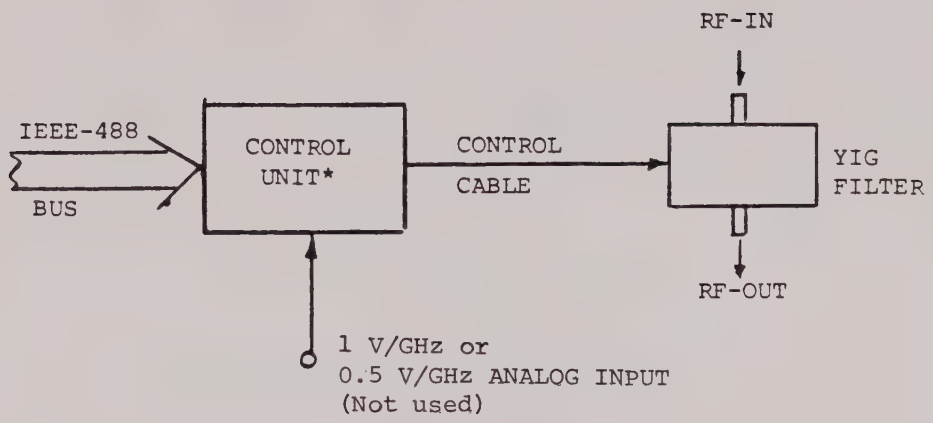
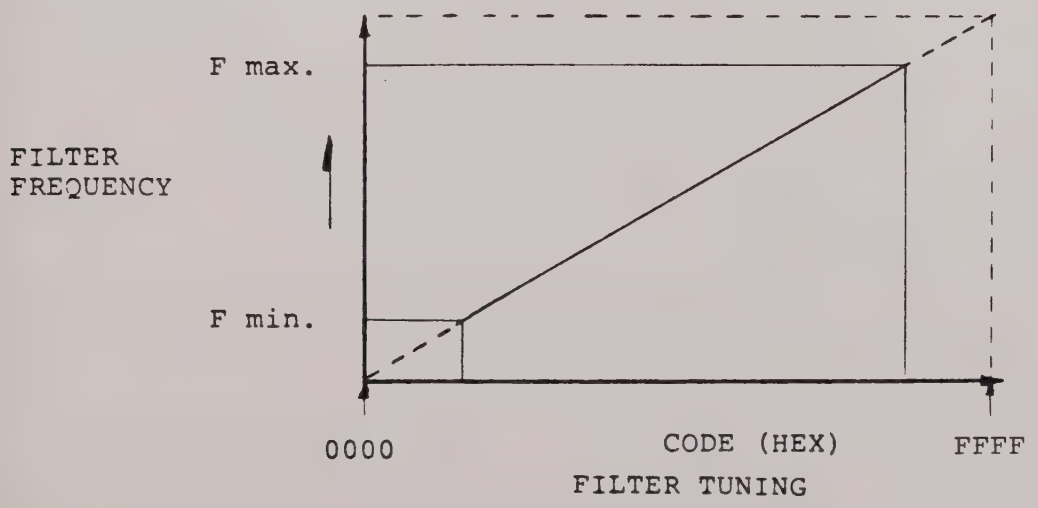
2.5.4 IEEE-488 Controlled Filter



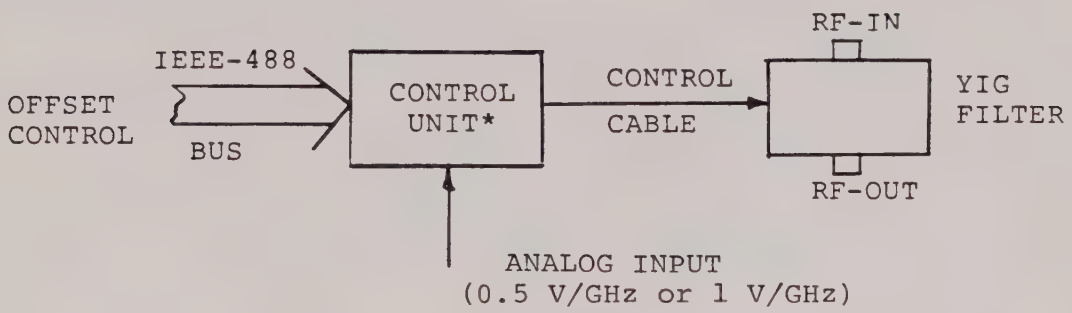
*CONTROL UNIT WITH IEEE-488 OPTION

The Tunable Microwave Filter TMF-1800K & M (with Option-02) can be controlled by the IEEE-488 Bus with 60,590 points resolution across the frequency range of the filter. If desired, the F1-offset control can be used by selecting the desired DIP-switches inside the control unit (See Table 1 for ranges). The gain control F2 is not active in this mode, and the analog input should be disconnected by choosing the proper control code.



FILTER TUNING

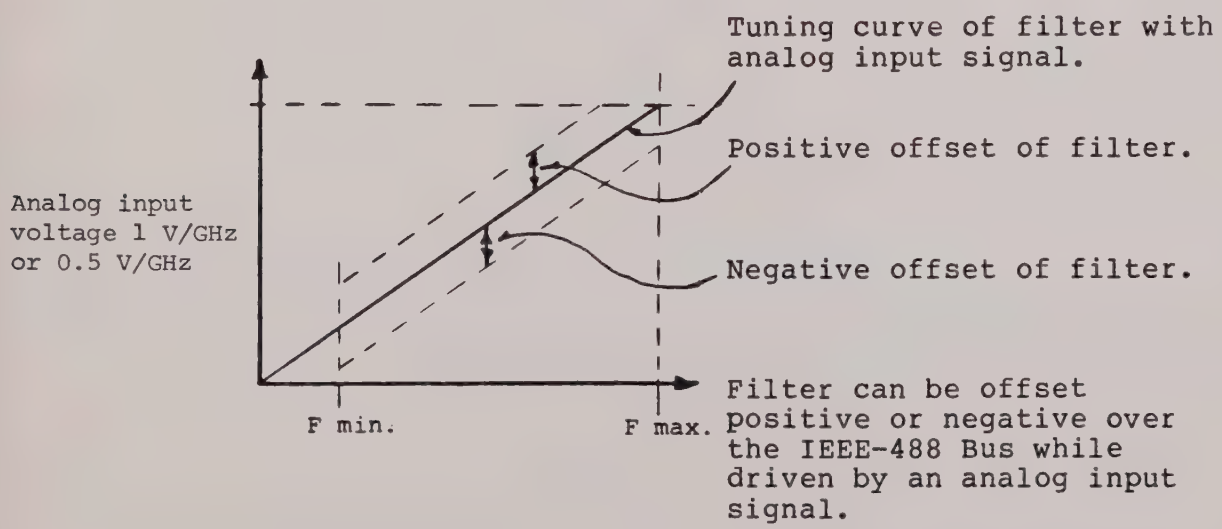
2.5.5 Analog Tracking With Digital Offset Control



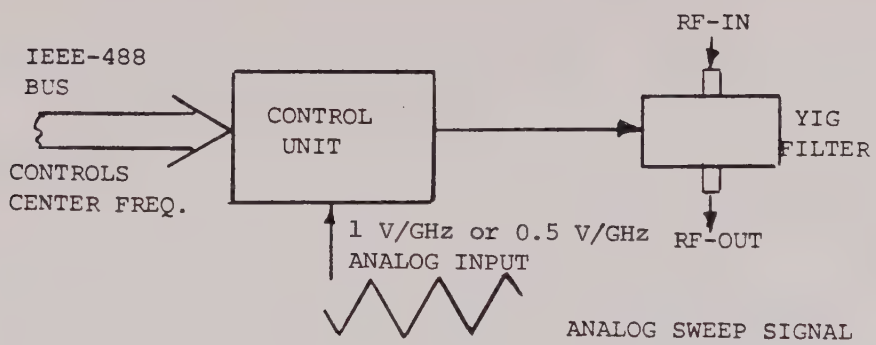
TRACKING FILTER WITH OFFSET

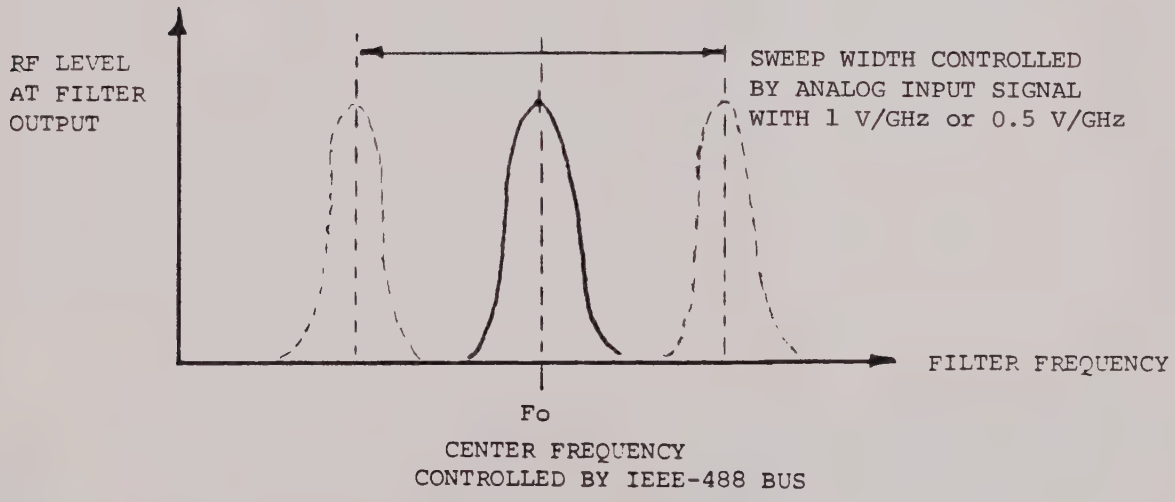
In this mode, the F1 and F2 controls are used to set-up the filter tracking with the analog input voltage and the digital offset is superimposed over the analog drive.

Typical applications are mixer testing, up-converters, down-converters, noise figure measurements.


Tuning curve of filter with analog input signal.
Positive offset of filter.
Analog input voltage 1 V/GHz or 0.5 V/GHz
Negative offset of filter.
F min.
F max.
Filter can be offset positive or negative over the IEEE-488 Bus while driven by an analog input signal.

2.5.6 Sweeping Filter With Digital Center Frequency Control





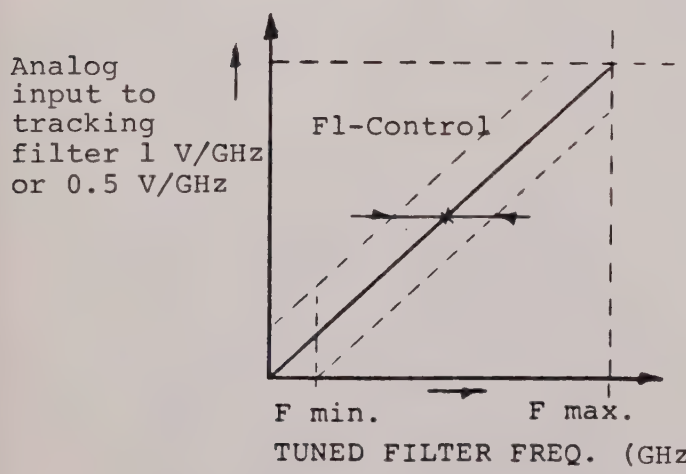
F1 and F2 controls can be used as required by selecting the appropriate Dip-Switches inside the control unit.

Typical Applications: Spectrum monitoring on oscilloscope, power measurements ect. (See application section).

3.0 THEORY OF OPERATION

3.1 System Operation

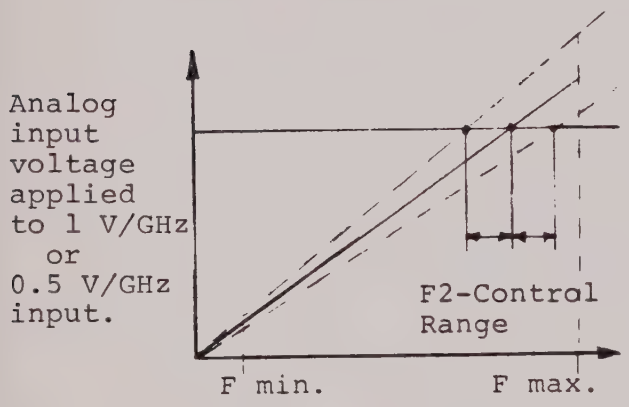
Fig. 3 is a block diagram of the INTEGRA Tunable Microwave Filter. In the analog drive mode, an external drive signal is applied to the EXT. DRIVE input. This is buffered and available at the buffered output to drive other instruments. The EXT. DRIVE SELECTOR selects the input range 1 V/GHz or 0.5 V/GHz. The drive section converts this signal to drive the YIG-filter. The F1-control provides a ± offset adjustment to compensate for small frequency "errors". This adjustment is independent of drive signal and moves the filter a fixed number of MHz (plus or minus). (See Fig. 5).



F1-control allows to offset the filter a constant amount plus or minus. This amount is controlled by F1-control (10 turn potentiometer on front panel of control unit and internal Range-selectors (Dip-switches). The Dip-switches can be controlled after removing the top cover of the TMF-1800 Control Unit.

Fig. 5 F1-Control

The F2-control is a fine adjustment for the external drive signal, and its effect is proportional to the drive signal (slope adjustment) (See Fig. 6).



The F2-control allows to change the gain of the filter driver and can correct if the driving signal at the input is not exactly 1.000 V/GHz or 0.500 V/GHz. The available range of F2 is a fixed percentage of the tuned filter frequency.

Fig. 6 F2-CONTROL

The YIG Filter is driven through a control cable and can be located directly in the RF-test set-up. The typical bandpass response is shown in Fig. 7 and a wide band response is shown in Fig. 8.

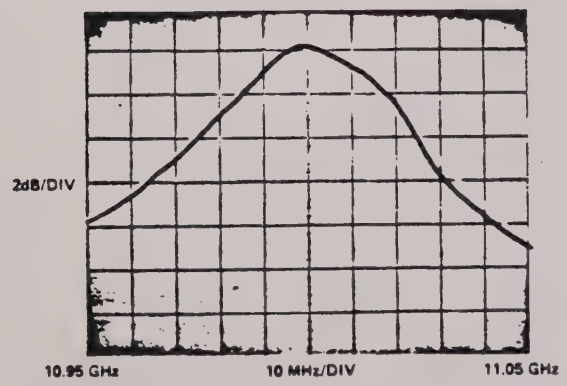


Figure 7 Band pass filter response of TMF-1800H Filter tuned to F_o=11 GHz. Note: Typical 3 dB band width of 45 MHz.

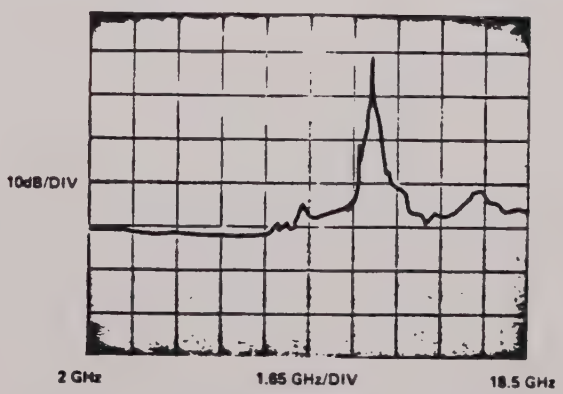


Figure 8 Frequency response of TMF-1800H Filter tuned to F_o=12.4 GHz. Note: 25 to 35 dB off resonance isolation.

The IEEE-488 Bus Control Option allows complete control over the TMF-1800K. The unit can be controlled with 65,536 points resolution over the frequency range. This gives a frequency resolution of 0.40436 MHz/code. The bus can also control relay A, B, and C. Relay A controls the positive drive. Relay B controls the negative frequency drive (used for negative offset, when the unit also uses the EXT. DRIVE INPUT). The Relay C allows to disconnect the EXT. INPUT DRIVE when only IEEE-488 bus control is desired.

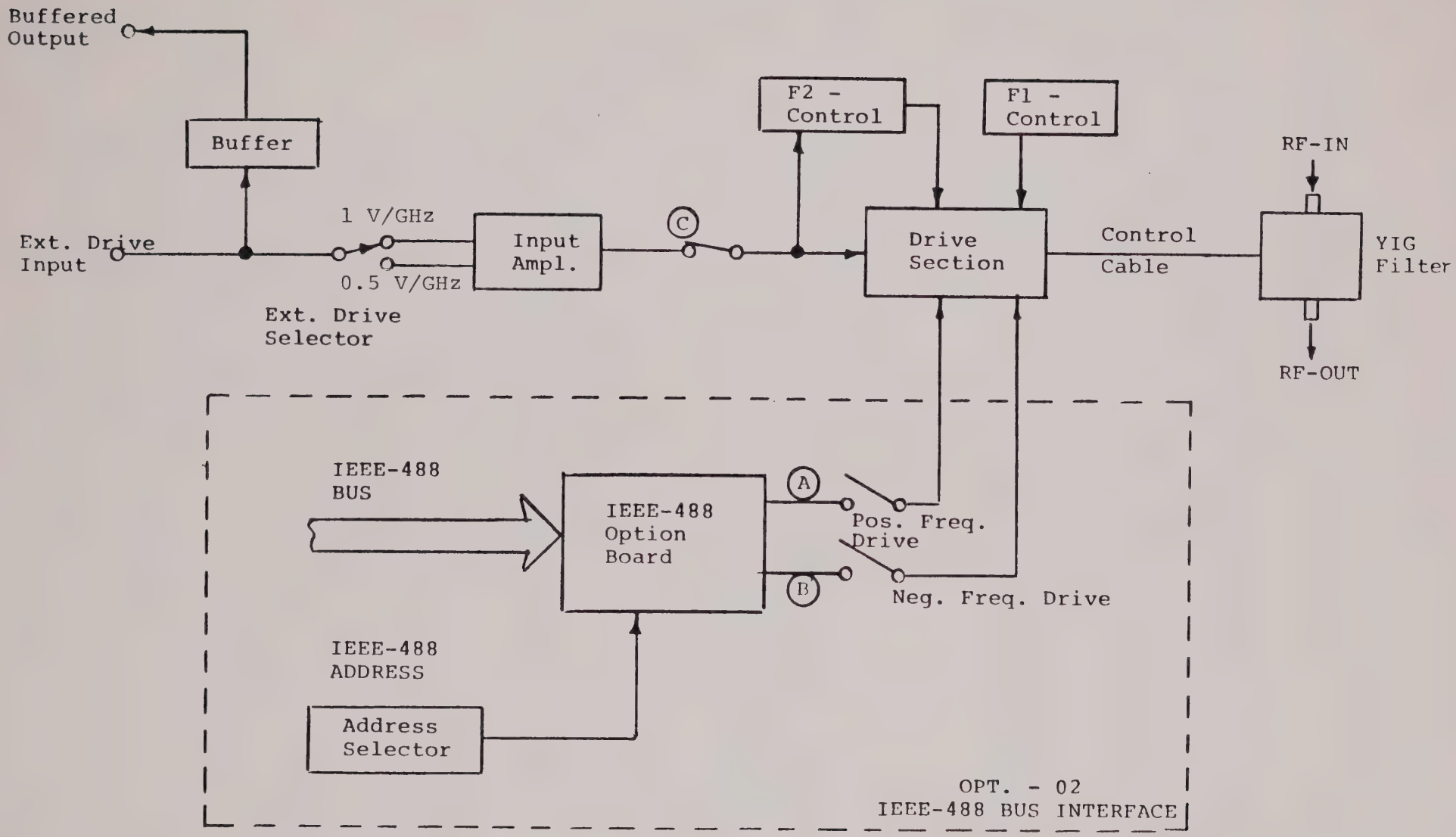


Fig. 3 TMF-Block Diagram

4.0 TMF-1800K CALIBRATION PROCEDURE

The Internal Voltage Calibration procedure section 4.1 and the IEEE-488 Calibration section 4.3 are only used after replacement of potentiometers, operational amplifiers or other parts on the main board or the IEEE-488 Interface Board.

The routine Frequency Calibration is covered in Section 4.2 FREQUENCY CALIBRATION. Routine Frequency Calibrations should be performed every 6 months.

4.1 Internal Voltage Calibration

Connect equipment as shown in fig. 9. Install 16 pin test adapter in sockets CH1, CH2 and CH3 located on the Control Unit mother board. Refer to fig. 10 for location of sockets and adjustment potentiometers.

4.1.1 Apply power to equipment and allow a warm-up period of 30 minutes before proceeding.

4.1.2 Power Supply Readings: (measured with reference to CH1-2 or CH2-1).

CH1-6: +13 VDC ±10%

CH1-7: -13 VDC ±10%

CH1-1: +11 VDC ±10%

CH1-14: +15 VDC ±5%

CH1-11: -15 VDC ±5%

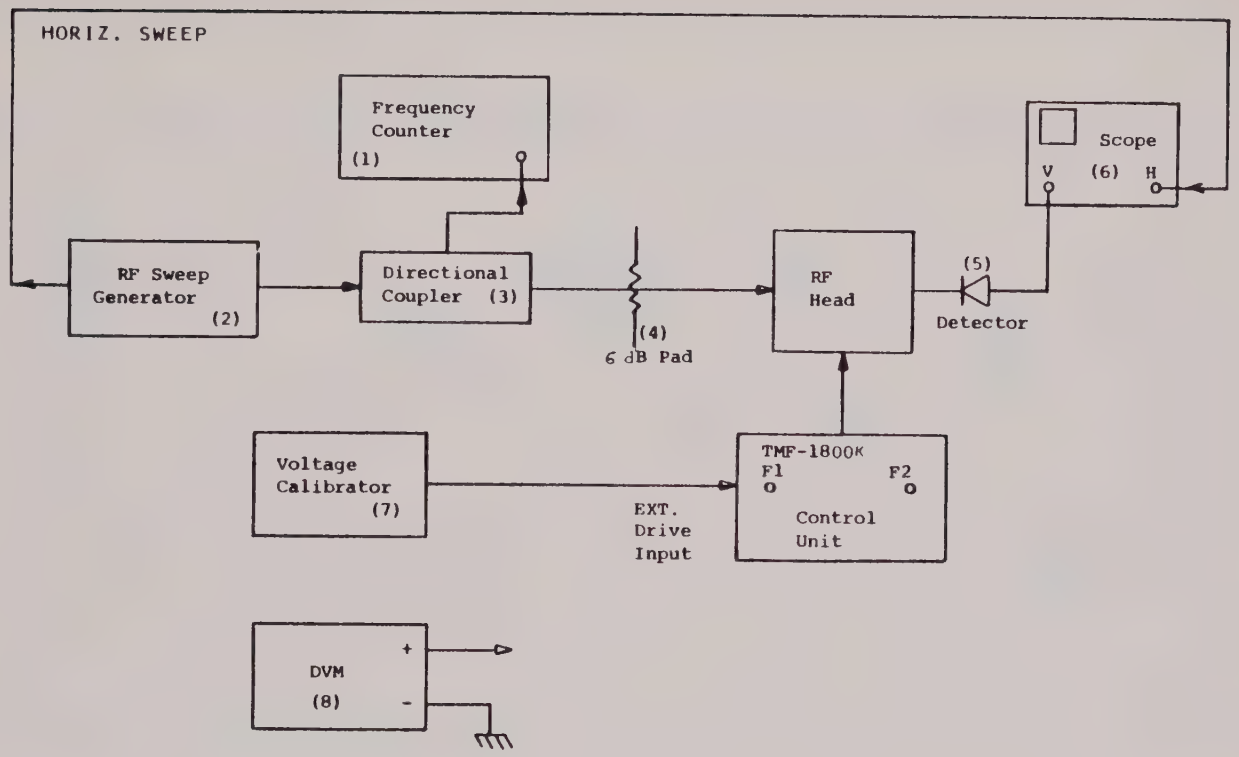
CH1-5: +5 VDC ±5%

4.1.3 Reference Voltage Adjustments:

Adjust R44 for +10.000 V at CH2-13

Adjust R45 for -10.000 V at CH2-12

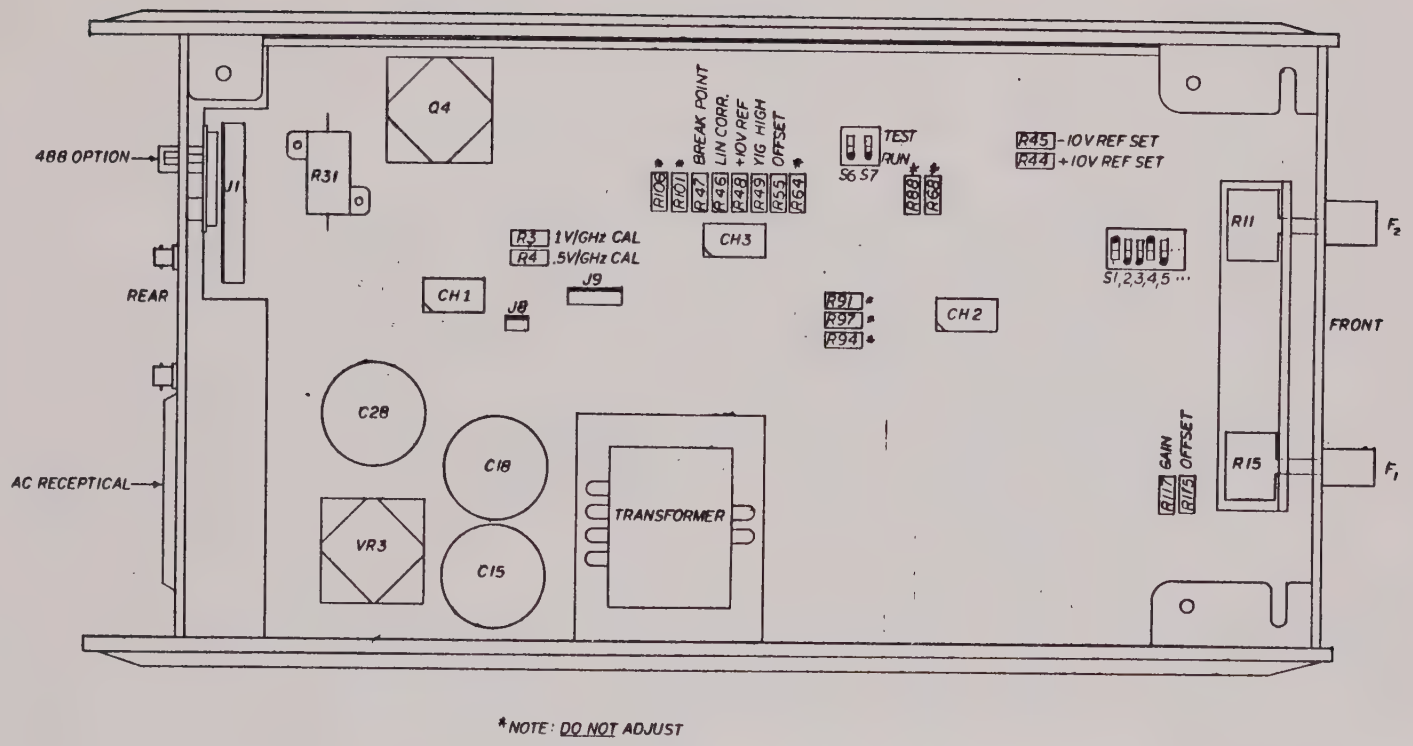
NOTE: CH1-2 & CH2-1 are chassis ground.



TEST EQUIPMENT LIST

	Item	Model No.	Mfg
1.	Frequency Counter	5342A	Hewlett-Packard
2.	Microwave Sweep Generator	MSG-2106	Integra
3.	Directional Coupler	1818	Krytar
4.	Attenuator	8493B-6	Hewlett-Packard
5.	Detector	33330B	Hewlett-Packard
6.	Oscilloscope	180A + 1801A	Hewlett-Packard
7.	Digital Voltage Calibrator	DVC-8500	Datel-Intersil
8.	Digital Voltmeter	3465B	Hewlett-Packard

Fig. 9 CALIBRATION TEST SET-UP



*NOTE: DO NOT ADJUST

Fig. 10
Parts Locations

4.1.4 External Drive Level Adjustments

Test No	Test Title	Inputs/Set-Up	Measure DVM On	With OSC On	Adj	Measure/Observe
1	zero input offset	open S1,S2,S3,S4,S5	CH3-12		R55	0.000 V
2		select .5 V/GHz input apply +13.250 VDC on EXT. DRIVE INPUT.	CH3-12		R4	+9.840 V
3		select 1 V/GHz input apply +19.999 VDC on EXT. DRIVE INPUT.	CH3-12		R3	+7.426 V
4	offset test	turn F1-ccw, close S1 input 0.000 V	CH3-12			≥ - 50 mV
5	offset test	open S1, close S2	CH3-12			≥ - 100 mV
6	offset test	open S2, close S3	CH3-12			≥ - 2.000 V
7	offset test	turn F1-cw	CH3-12			≥ 2.000 V
8	offset test	open S3, close S2	CH3-12			≥ 0.100 V
9	offset test	open S2, close S1	CH3-12			≥ 0.050 V
10	offset test	open S1, close S4 select .5V/GHz,F2-ccw input +13.250 V	CH3-12			< 9.865 V
11	offset test	open S4, close S5	CH3-12			< 9.865 V
12	offset test	open S4, close S5	CH3-12			< 9.865 V
13	offset test	F2 - cw	CH3-12			> 10.135 V
14	offset test	open S5, close S4	CH3-12			> 10.090 V
15		zero set of linearizer	CH3-15		R46	0.00 V
16			CH3-2		R47	max. neg. voltage

4.2 Frequency Calibration

4.2.1 Connect instrument as shown in fig. 9.

4.2.2 Select .5 V/GHz and set S1 and S4 to ON and S2, S3, and S5 to OFF.

4.2.3 Set VOLTAGE CALIBRATOR to 1.000 V.

4.2.4 Measure @ CH3-12 adj. F1 for +0.755 V.

4.2.5 Set sweeper freq to 2.000 GHz.

4.2.6 Adj. R48 for max signal on scope.

4.2.7 Set VOLTAGE CALIBRATOR to 13.250 V.

4.2.8 Measure @ CH3-12 adj. F2 for +10.000 V.

4.2.9 Set sweeper freq. to 26.500 GHz.

4.2.10 Adj. R49 for max signal on scope.

4.2.11 Repeat steps 4.2.3 thru 4.2.11 until both points are calibrated.

4.2 Frequency Calibration

4.2.1 Connect instrument as shown in fig. 9.

4.2.2 Select .5 V/GHz and set S1 and S4 to ON and S2, S3, and S5 to OFF.

4.2.3 Set VOLTAGE CALIBRATOR to 1.000 V.

4.2.4 Measure @ CH3-12 adj. F1 for +0.755 V.

4.2.5 Set sweeper freq to 2.000 GHz.

4.2.6 Adj. R48 for max signal on scope.

4.2.7 Set VOLTAGE CALIBRATOR to 13.250 V.

4.2.8 Measure @ CH3-12 adj. F2 for +10.000 V.

4.2.9 Set sweeper freq. to 26.500 GHz.

4.2.10 Adj. R49 for max signal on scope.

4.2.11 Repeat steps 4.2.3 thru 4.2.11 until both points are calibrated.

4.3 IEEE-488 Calibration for Option-02

PROCEDURE: To be performed after all other voltage calibration. (Section 4.1) See fig. 11 for Calibration Set Up.

NOTE: All Adj. are on IEEE-488 Interface Board Board and measurement points are on main board.

4.3.1 Open all switches S1 - S5 and set-up per fig. 11.

4.3.2 Command with controller "0000011"
and adj: R4 for 0.000 V on CH3-12.

4.3.3 Command "????011"
and adj: R2 for - 10.000 V.

4.3.4 Repeat 2 and 3 until both correct.

4.3.5 Command "0000101" and adj: R 16 for 0.000 V.

4.3.6 Command "????101" and adj: R23 for +10.000 V.

4.3.7 Repeat 4.3.5 and 4.3.6 until both correct.

4.3.8 End of calibration.

4.4 Frequency Adjustments

4.4.1 Set drive range switch to 0.5 V/GHz, and apply 1.000 V to EXT. Drive Input from voltage calibrator.
Set F1 control for reading of 0.500 V at CH1-12.
Apply 11.000 V from calibrator. Adjust F2 control for reading of 5.500 V at CH1-12.

4.4.2 Set voltage calibrator to 11.000 V.
Apply CW signal of 22.000 GHz to RF Head.
Adjust R49 for maximum detected RF power indication on oscilloscope (use internal sweep).

4.4.3 Set voltage calibrator to 1.000 V.
Apply CW signal of 2.000 GHz to RF Head.
Adjust R48 for maximum detected RF power indication on oscilloscope.
Steps 4.5.2 and 4.5.3 must be repeated until both readings are correct.

4.4.4 Set voltage calibrator to 13.000 V.
Apply CW signal of 26.000 GHz to RF Head.
Adjust R46 for maxium detected RF power indication.

4.4.5 Set voltage calibrator to Zero Volts and then to 11.000 V. (removes hysteresis)
Apply CW signal of 22.000 GHz to RF Head.
Adjust R47 for maximum detected RF power indication.
Steps 4.5.4 and 4.5.5 must be repeated until both readings are correct.

4.5 Frequency Tracking Adjustment

Remove voltage calibrator and connect sweep generator analog output (0.5 V/GHz) to control unit input.

Set drive range switch to 0.5 V/GHz position. Adjust sweep generator sweep range for 2 to 26.5 GHz at a rate of 1 second per sweep.

Observe detected owtput signal an oscilloscope while adjusting F1 and F2 controls for maximum detected level. Levels should be comparable to CW readings over entire sweep range.

4.6 Verification Of Drive Output

Connect voltage calibrator to EXT. drive input and set level to 18.000 V. Drive output level should be 18.000 V $\pm$ 30 mV.

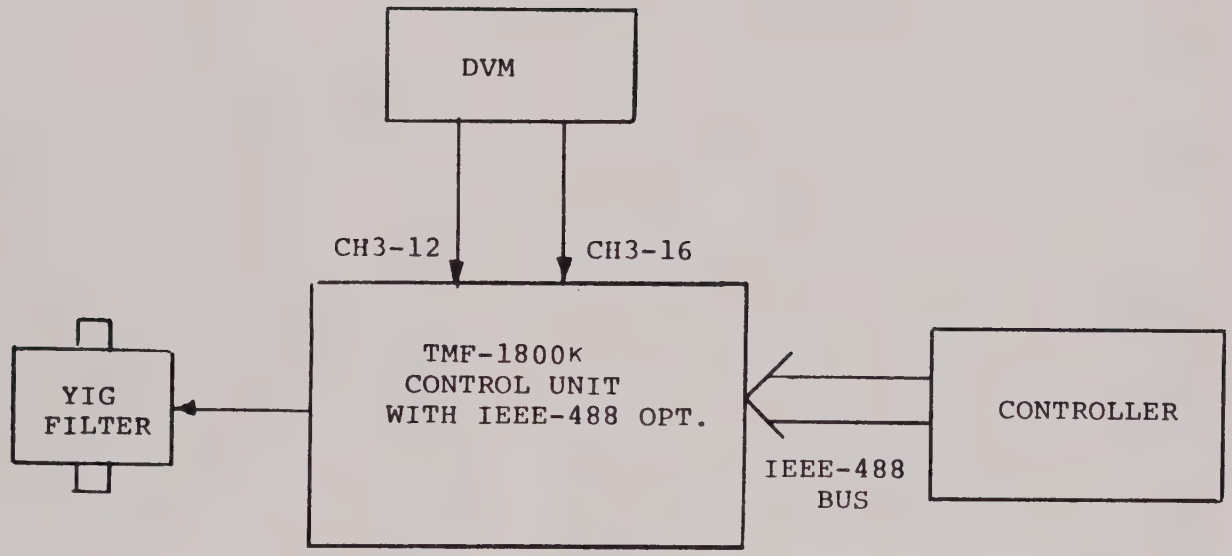


Fig. 11 IEEE-488 CALIBRATION SET UP

5.0 CIRCUIT DESCRIPTION

5.1 GENERAL

Figure 12 is a block diagram of the TMF-1800K. The drive input selector switch selects the 1 V/GHz or 0.5 V/GHz sensitivity for the EXT. Drive Input. The buffered analog output makes the input drive signal available for other instruments. The F1 control provides an offset adjustment compensating for the input drive signal. (See Table 1 for range) This offset is constant accross the entire tuning range. The F2 control provides a ± slope adjustment. (See Table 2 for range) This adjustment is proportional to frequency and is only effective on the EXT. Drive Input. (No effect on IEEE-488 Control) The drive section also incorporates a linearizer circuit and temperature compensation circuitry.

The RF filter is connected to the Driver Unit through a 5 foot cable (10 ft, optional).

The IEEE-488 OPTION can control the Filter when positive Frequency Drive (Relay A) is selected. Relay B can enable a negative Frequency Drive. (Used together with the EXT. Drive Input to provide a negative frequency offset). Relay C is also controlled by the IEEE-488 Bus Interface and allows to disconnect the External Drive Input.

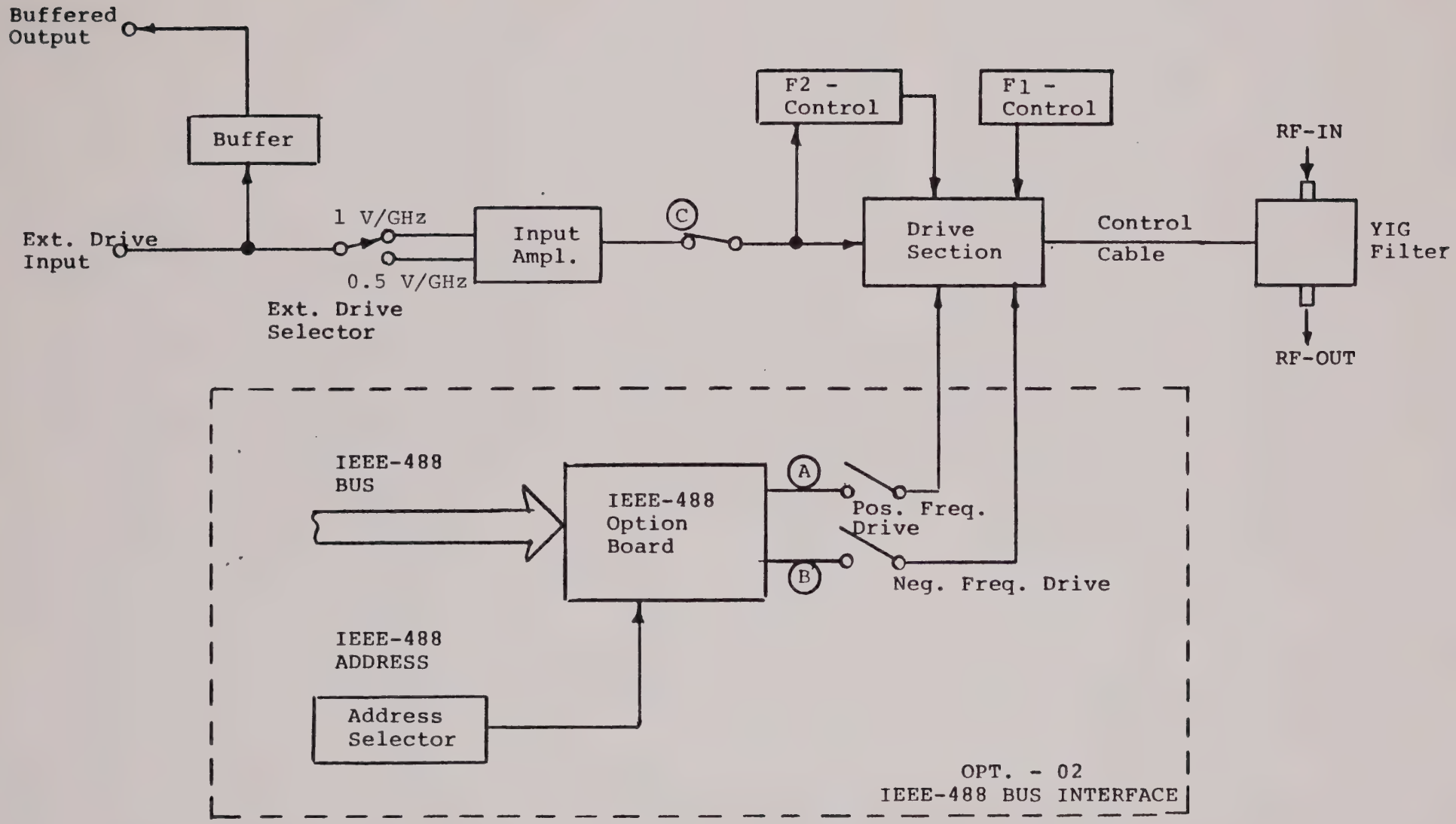


Fig. 12 TMF-Block Diagram

5.2 Circuit Description, Control Unit

(See TMF-1800K Interconnect and Schematic Mother Board TMF-1800K)

Power Supply

Transformer T1 has 3 secondary windings to feed 3 independent integrated regulators (VR1-3). Diodes CR5-CR12 and CR25-CR28 form three bridge rectifiers. Diodes CR13-16 and CR23-24 are reverse polarity protections for the integrated regulators. CR18 is a LED-power indicator for the front panel.

Ref. Voltage Supply

IC5 is a +10.000 V-Positive Ref. Supply (adjustable by R44). IC6 generates a -10.000 V reference voltage (adjustable by R45).

Buffer Amplifier

IC7 is a high voltage buffer amplifier for the EXT. Drive signal. The gain is +1.

EXT. Drive Input Amplifier

IC1 is an inverting amplifier and accepts either 0 to 20 V (on CH1-10) or 0 to 10 V (on CH1-9). R3 and R4 calibrate the input ranges. CR22 limits the output range and polarity of IC1.

INTERNAL SUMMING AMPLIFIER

IC2 is the internal summing amplifier. IC2, R13, and R16 form an inverting amplifier with a gain of -1. R55-R60 provide an offset voltage compensation for IC2.

R14, R80-82, R85, R86, S1-S3 in conjunction with the F1-Control potentiometer R15 give a positive or negative offset. The selector switches S1-S3 allows to select the desired range of F1-Control. (OFFSET CONTROL)

The output of IC1 (after passing through relay K1) is applied to the F2-Control (R11) and through S4, S5, R12, and R79 control the gain of IC2 in respect to the EXT. DRIVE INPUT. (SLOPE CONTROL) Relay K1 controls the EXT. DRIVE INPUT to IC2. It is controlled by the IEEE-488 Interface Board. Its normal position (power up) is contacts closed.

Relay K2 applies a 0 to +10 V signal from the IEEE-488 Board to R76 for negative offset.

Relay K3 applies a 0 to -10 V signal from the IEEE-488 Board to R78 for positive offset (When used with EXT. INPUT DRIVE), or as the main drive signal when the EXT. INPUT DRIVE is disconnected by Relay K1.

Remote Indicator Circuit

CR24-CR31, R73, 74, 83, 84, and R87 form a REMOTE-indicator. Whenever any of the 3 relays is activated the REMOTE indicator CR31 lights up.

Yig Driver

IC3 is the YIG-Driver summing amplifier. R17, R18, and R48 allow YIG-LOW FREQUENCY CALIBRATION. R19, R20, and R49 are used for YIG HIGH FREQUENCY CALIBRATION. R21-23 and C8 is an optional YIG delay compensation circuit.

IC4 and Q1-Q4 form a current booster for the YIG driver. R31 is the current sense resistor and feeds back a voltage proportional to the YIG current.

Control Unit TC-Comp

CR35 is a temperature sensor and IC10 amplifies the voltage proportional to temperature. R105 and R106 are offset adjustment to set the output of IC10 to 0 V at room temperature. R99-R103 form a bridge circuit and allows setting of the desired amount of temperature compensation.

YIG-Offset TC-Comp

IC8 amplifies the output of a temperature sensor in the YIG unit. R64, R65 are offset adjustments to set the output of IC8 to 0 V at room temperature. R88, 89, and R114 control the amount of offset TC-COMP applied to IC3.

YIG-Scope TC-COMP

IC9 multiplies the drive signal (IC2-output) with the measured YIG temperature signal from output of IC8.

R67-71 form a bridge circuit and allows setting of the desired amount of temperature compensation.

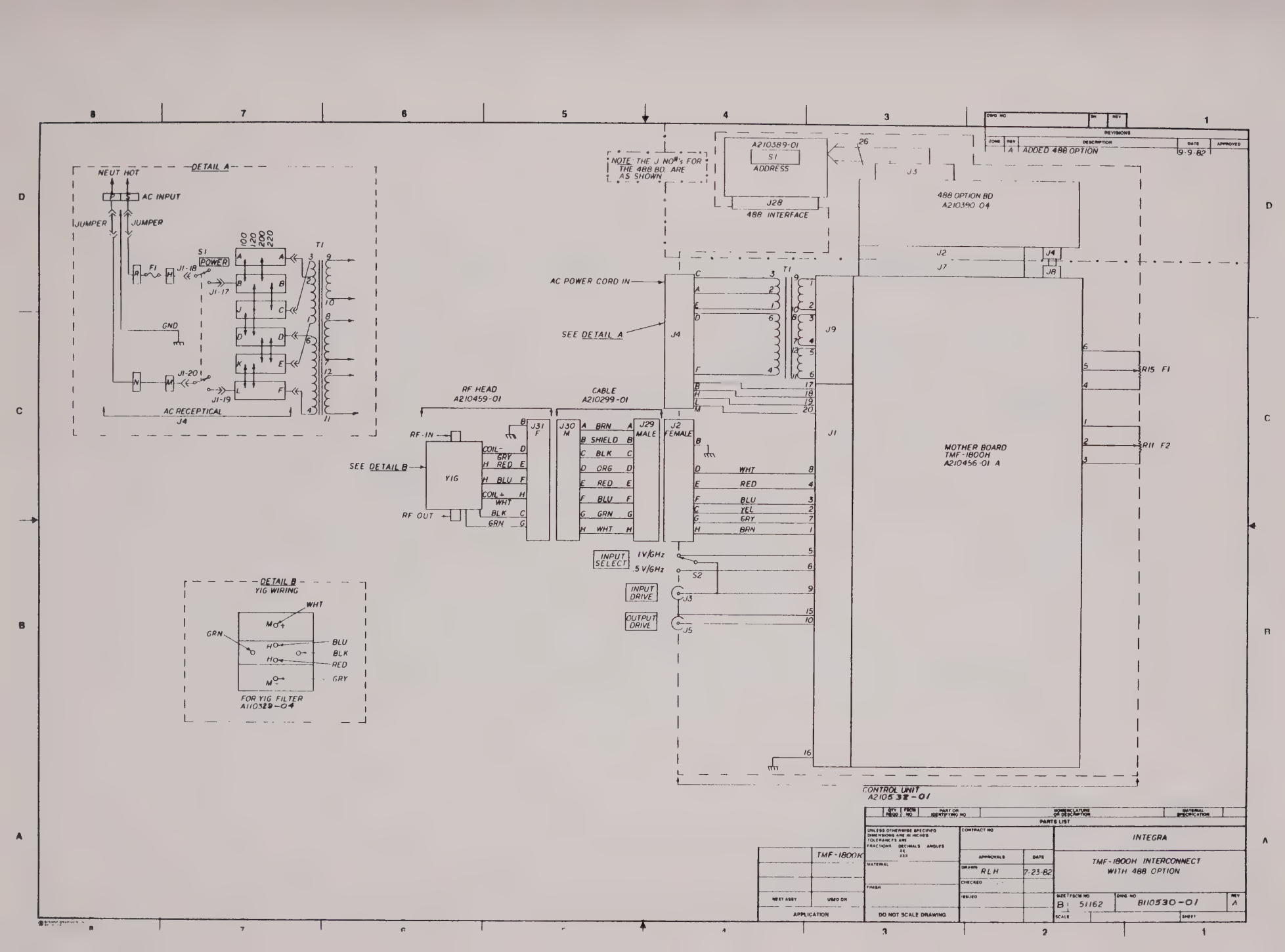
YIG Linearizer

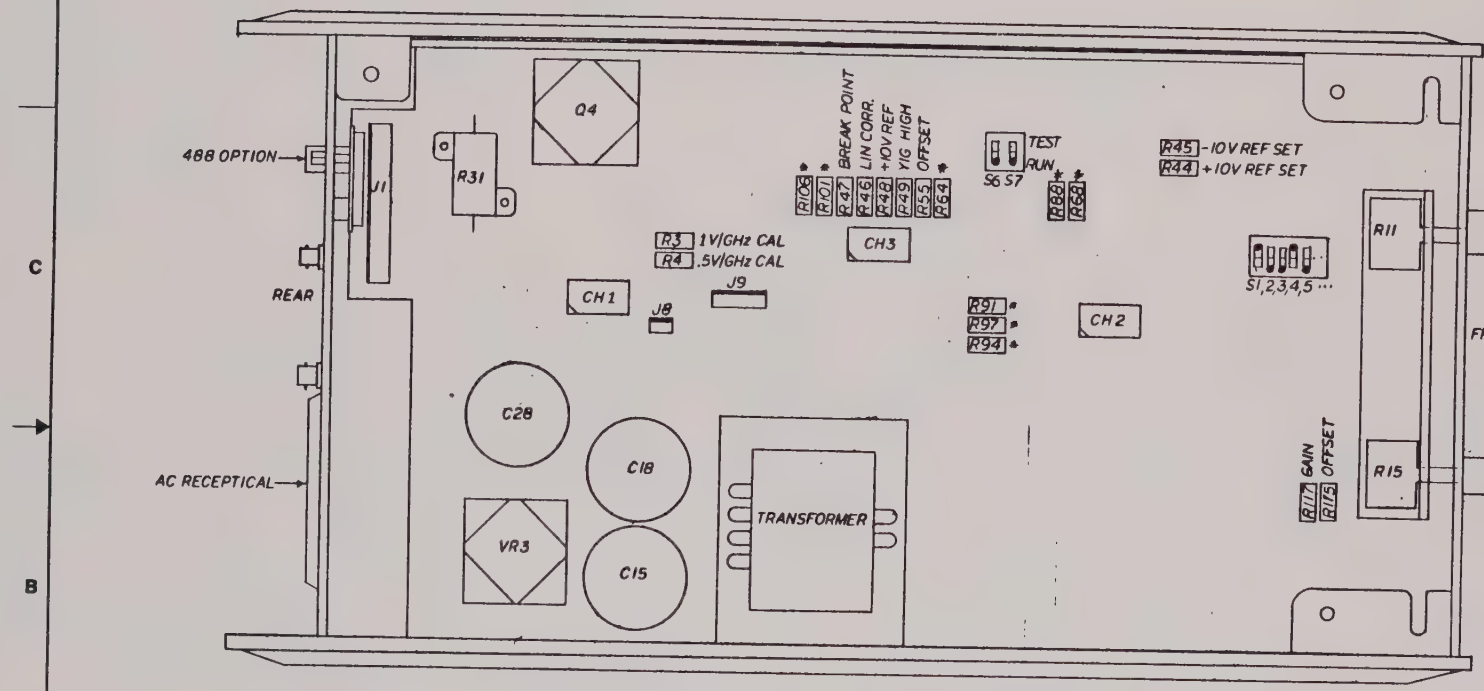
R38, 39, 46, 47, and CR3 form an adjustable linearizer circuit to compensate for YIG nonlinearity (Optional).

5.3 Circuit Description, IEEE-488 Interface Board

The 488 Board is controlled by way of the 488 Interface Bus. The data is received and transmitted by IC19 and IC20. LED (CR7) indicates the power-up procedure is complete. IC8 is the central processor which sends instructions to IC9 and IC10. IC9 controls IC1 which is a 16 bit digital to analog converter. IC1 provides the 0 to +10.000 V analog signal. IC21 inverts the analog signal to supply 0 to -10.000 V. IC10 provides the control signal for K1, 2, and 3 on the Mother Board.

6.0 Schematics and Assembly Drawings


DETAIL A
NEUT HOT
AC INPUT
JUMPER
JUMPER
S1
POWER
100
120
200
220
T1
F1
J1-18
J1-17
J1-20
J1-19
GND
AC RECEPTICAL
J4
NOTE THE J NO#'s FOR THE 488 BD. ARE AS SHOWN
A210389-01
S1
ADDRESS
J28
488 INTERFACE
488 OPTION BD
A210390 04
J3
J2
J7
J4
J8
AC POWER CORD IN
SEE DETAIL A
J4
T1
J9
J1
MOTHER BOARD
TMF-1800H
A210456-01 A
R15 F1
R11 F2
RF HEAD
A210459-01
CABLE
A210299-01
SEE DETAIL B
RF IN
RF OUT
YIG
J31
F
J30
M
J29
MALE
J2
FEMALE
COIL-
COIL+
BRN
SHIELD
BLK
ORG
RED
BLU
GRY
WHT
GRN
INPUT SELECT
1V/GHz
.5V/GHz
S2
INPUT DRIVE
OUTPUT DRIVE
J3
J5
DETAIL B
YIG WIRING
FOR YIG FILTER
A110329-04
CONTROL UNIT
A2105 32-01
REVISIONS
ZONE
REV
DESCRIPTION
DATE
APPROVED
A
ADDED 488 OPTION
9-9-82
PARTS LIST
QTY PER UNIT
PART OR IDENTIFYING NO
NOMENCLATURE OR DESCRIPTION
MATERIAL SPECIFICATION
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS
DECIMALS
ANGLES
CONTRACT NO
APPROVALS
DATE
DRAWN
RLH
7-23-82
CHECKED
ISSUED
MATERIAL
FINISH
NEXT ASSY
USED ON
TMF-1800K
APPLICATION
DO NOT SCALE DRAWING
INTEGRA
TMF-1800H INTERCONNECT WITH 488 OPTION
SIZE
FSCM NO
51162
DWG NO
B110530-01
REV
A
SCALE
SHEET



*NOTE: DO NOT ADJUST

QTY. REQD	FIGURE NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS DECIMALS ANGLES
.XX ±
.XXX ±

CONTRACT NO.

APPROVALS	DATE
DRAWN RLH	8-2-82
CHECKED	
ISSUED	

MATERIAL

FINISH

DO NOT SCALE DRAWING

NEXT ASSY	USED ON
APPLICATION	

TMF-1800H

INTEGRA

ADJUSTMENT POT ORIENTATION

SIZE	FSCM NO.	DWG. NO.	REV.
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SCALE SHEET

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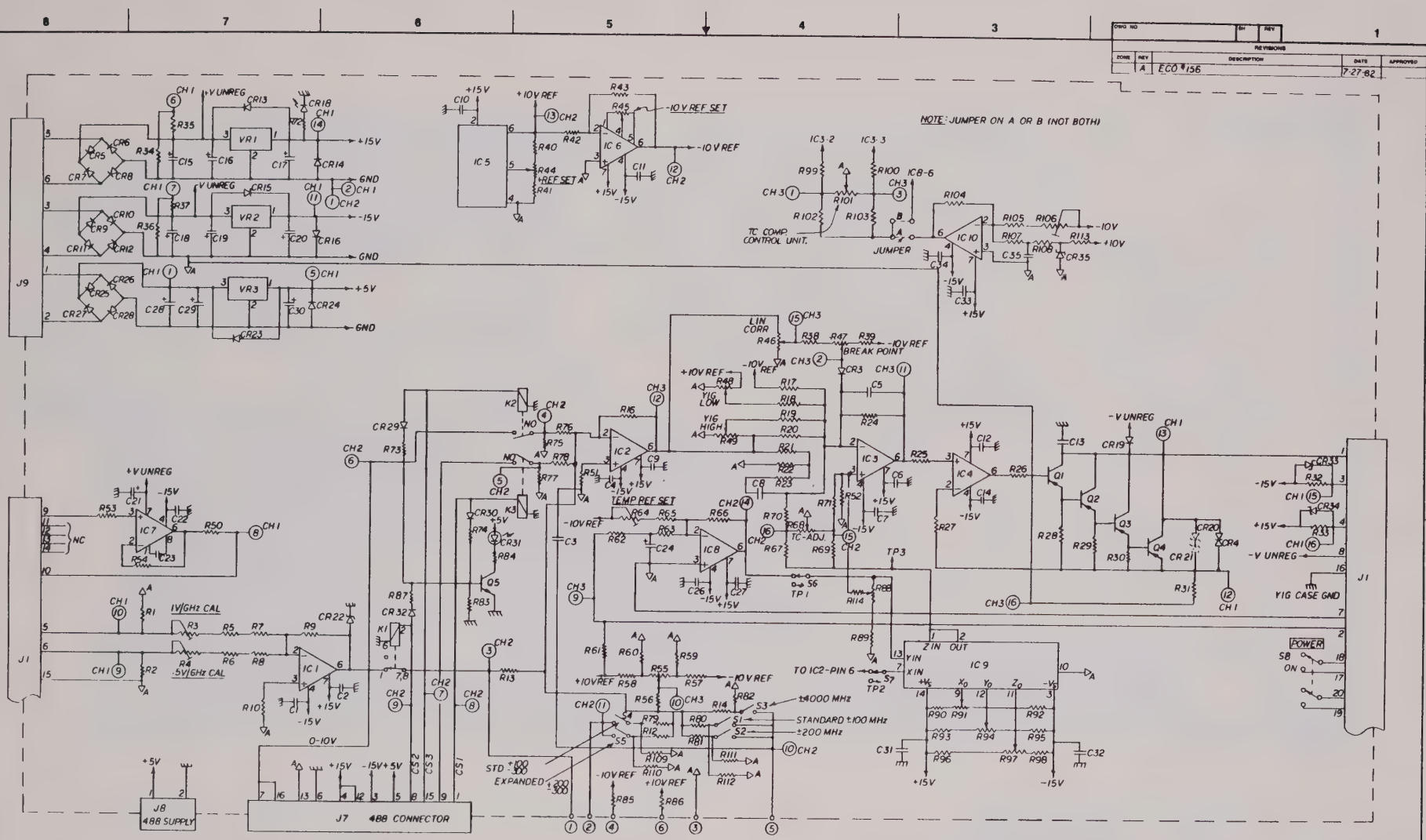

LAST USED: Q5, J9, S8, VR3, IC10, C35, CR35, R114, TP3

REVISIONS				
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	A	ECO #156	7-27-82	

PARTS LIST				
QTY PER UNIT	FSCM NO	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

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FINISH	DRAWN RLH 7-27-82
NEXT ASSY / USED ON	CHECKED 8-27-82
APPLICATION	ISSUED
DO NOT SCALE DRAWING	

TMF-1800K

INTEGRA

SCHEMATIC, TMF-1800K WITH 488 OPTION

SIZE	FSCM NO	DWG NO	REV
B	51162	B110456-02	A

SCALE — SHEET

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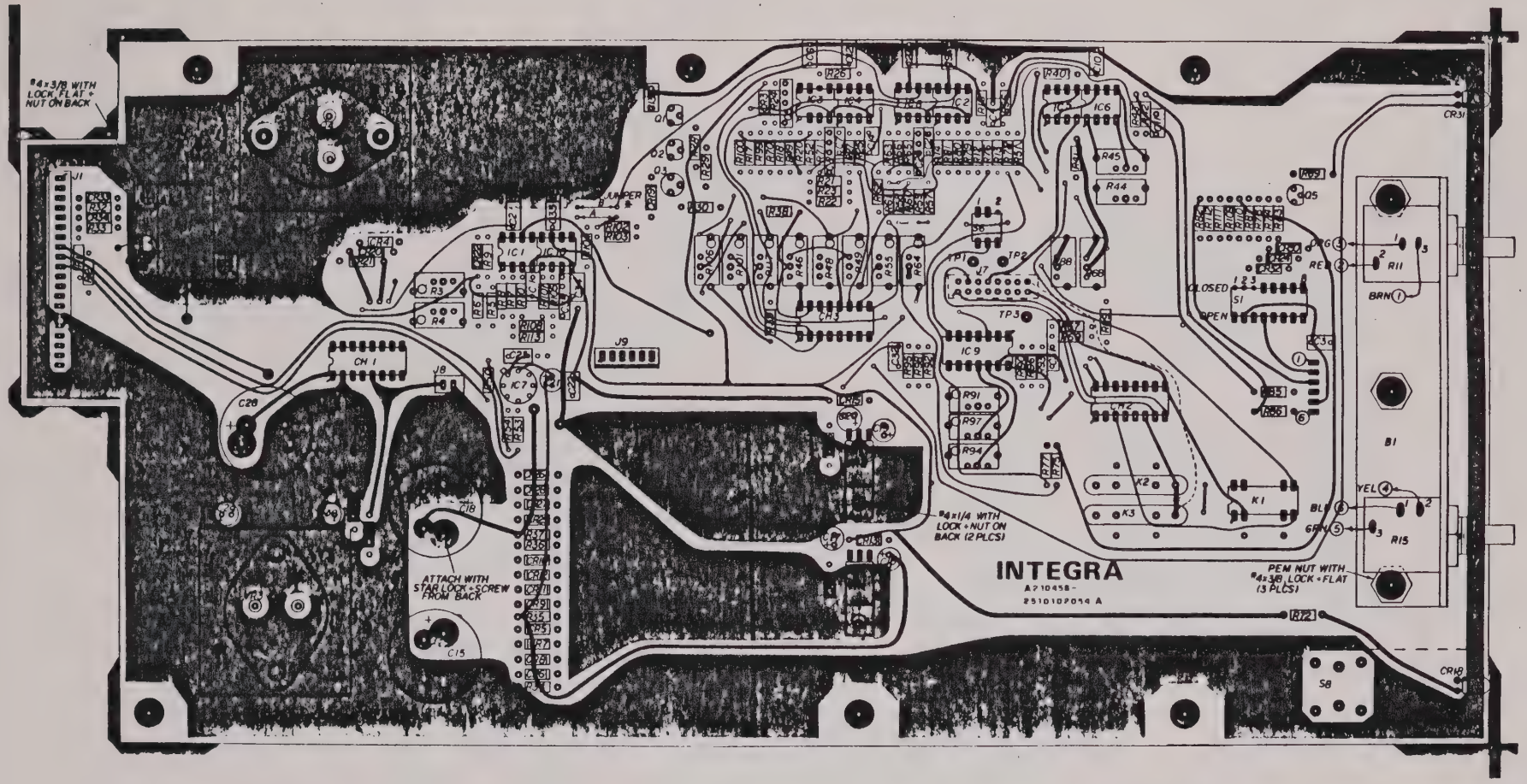
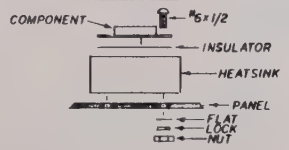


Q4 + VR3 ASSY.



#NOTE: JUMPER A OR B (NOT BOTH)

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NEXT ASSY	USED ON		
APPLICATION		DO NOT SCALE DRAWING	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS DECIMALS ANGLES
XX ±
XXX ±

MATERIAL

FINISH

CONTRACT NO.

APPROVALS	DATE
DRAWN RLH	8-30-82
CHECKED	
ISSUED	

INTEGRA

MOTHER BOARD ASSEMBLY

SIZE	FSCM NO.	DWG NO.	REV
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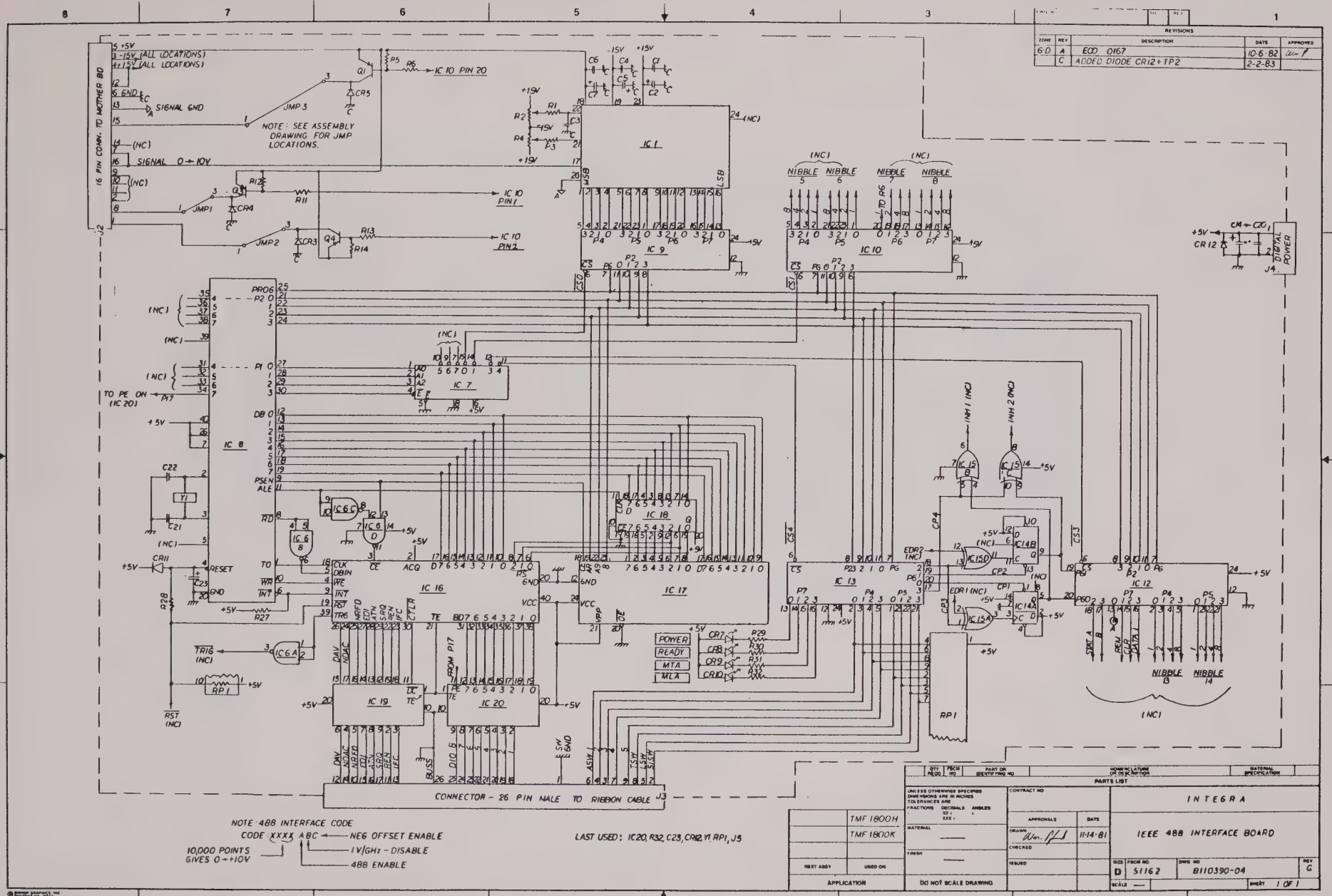
SCALE SHEET


REVISIONS
ZONE | REV | DESCRIPTION | DATE | APPROVED
6-D | A | ECO 0167 | 10-6-82 |
C | ADDED DIODE CR12 + TP2 | 2-2-83 |
16 PIN CONN. TO MOTHER BD
J2
+5V (ALL LOCATIONS)
-15V (ALL LOCATIONS)
GND
SIGNAL GND
SIGNAL 0 → 10V
NOTE: SEE ASSEMBLY DRAWING FOR JMP LOCATIONS.
JMP 1
JMP 2
JMP 3
IC 10 PIN 20
IC 10 PIN 1
IC 10 PIN 2
IC 1
IC 9
IC 10
NIBBLE 5
NIBBLE 6
NIBBLE 7
NIBBLE 8
DIGITAL POWER
J4
IC 8
IC 7
IC 18
IC 16
IC 17
IC 13
IC 12
IC 19
IC 20
TO PE ON (IC 20)
RESET
RST (NC)
TRIG (NC)
POWER
READY
MTA
MLA
NIBBLE 13
NIBBLE 14
CONNECTOR - 26 PIN MALE TO RIBBON CABLE J3
NOTE 488 INTERFACE CODE
CODE XXXX ABC
10,000 POINTS GIVES 0 → +10V
NEG OFFSET ENABLE
1V/GH1 - DISABLE
488 ENABLE
LAST USED: IC20, R32, C23, CR12, Y1, RP1, J3
PARTS LIST
TMF 1800H
TMF 1800K
APPLICATION
DO NOT SCALE DRAWING
INTEGRA
IEEE 488 INTERFACE BOARD
SIZE D
PSCM NO. 5116 2
DWG NO 8110390-04
REV G
SCALE —
SHEET 1 OF 1

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
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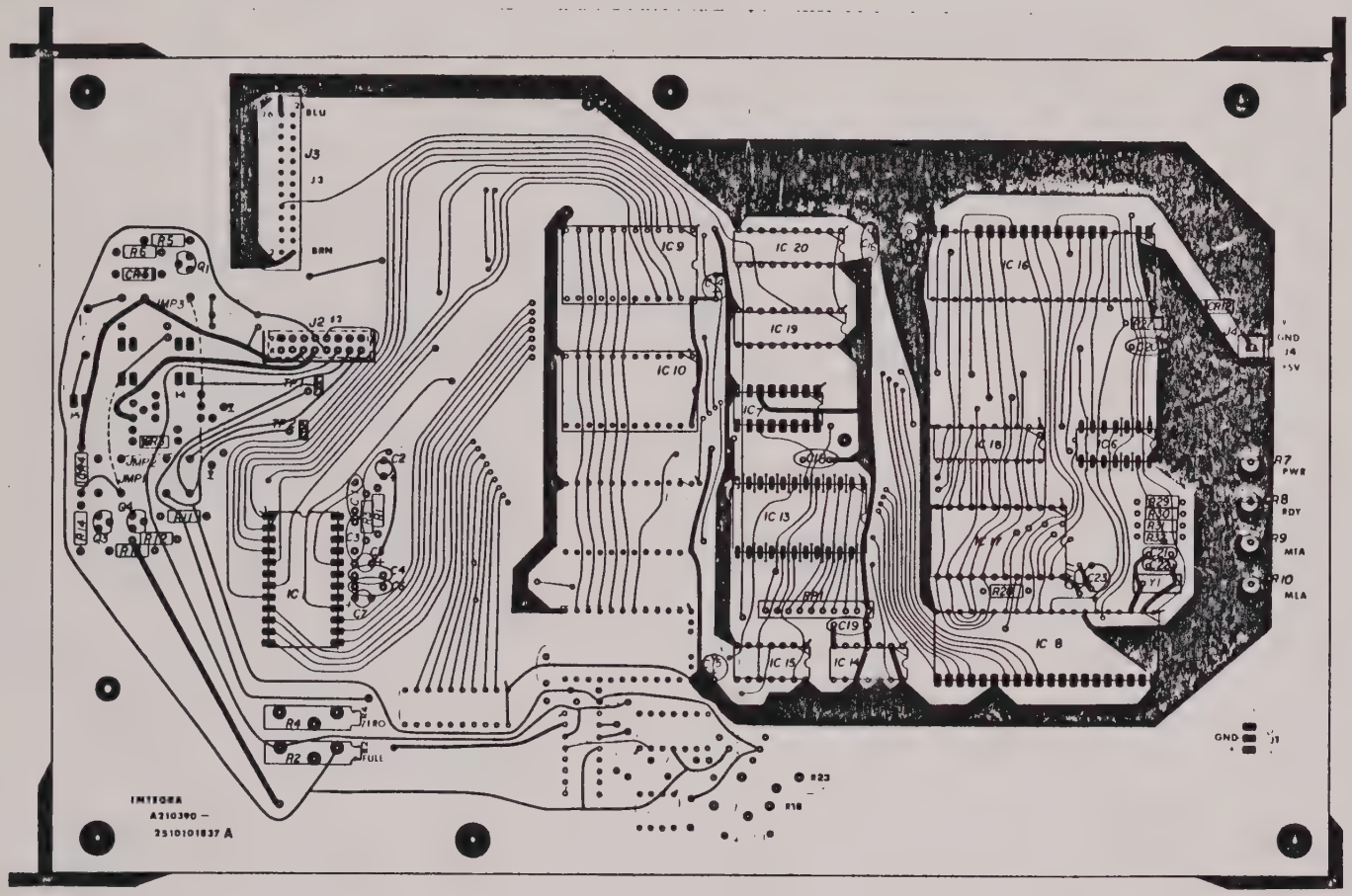
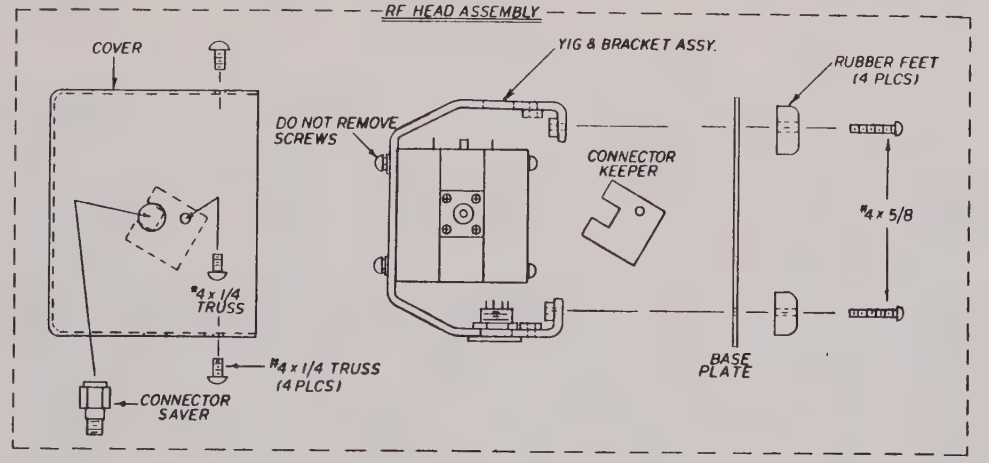
	C	ADDED DIODE CR12 + TP2	2-2-83	

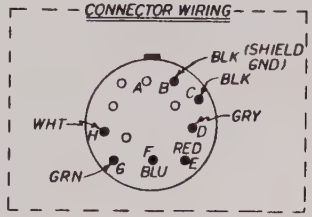


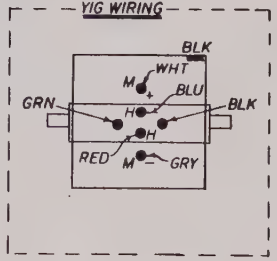
LAST USED: IC20,R32,C23,CR12,Y1,RP1,J5

PARTS LIST				
QTY REQD	CODE IDENT	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

	TMF-1800H	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS DECIMALS ANGLES .XX ± .XXX ±	CONTRACT NO	INTEGRA
	TMF-1800K	MATERIAL	APPROVALS DRAWN Alan Ref 11-14-81	IEEE 488 INTERFACE BOARD
		FINISH	CHECKED	
NEXT ASSY	USED ON		ISSUED	SIZE D FSCM NO 51162 DWG NO B210390-04 REV G
APPLICATION		DO NOT SCALE DRAWING		SCALE 2:1 SHEET 1 OF 1







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PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS DECIMALS ANGLES .XX ± .XXX ±	CONTRACT NO.
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FINISH	DRAWN RLH 7-23-82
NEXT ASSY / USED ON	CHECKED 7-27-82
APPLICATION	ISSUED
DO NOT SCALE DRAWING	

TMF-1800K

INTEGRA

RF HEAD ASSEMBLY

SIZE | FSCM NO. 51162 | DWG. NO. B210531-01 | REV

SCALE | SHEET 1 OF 2

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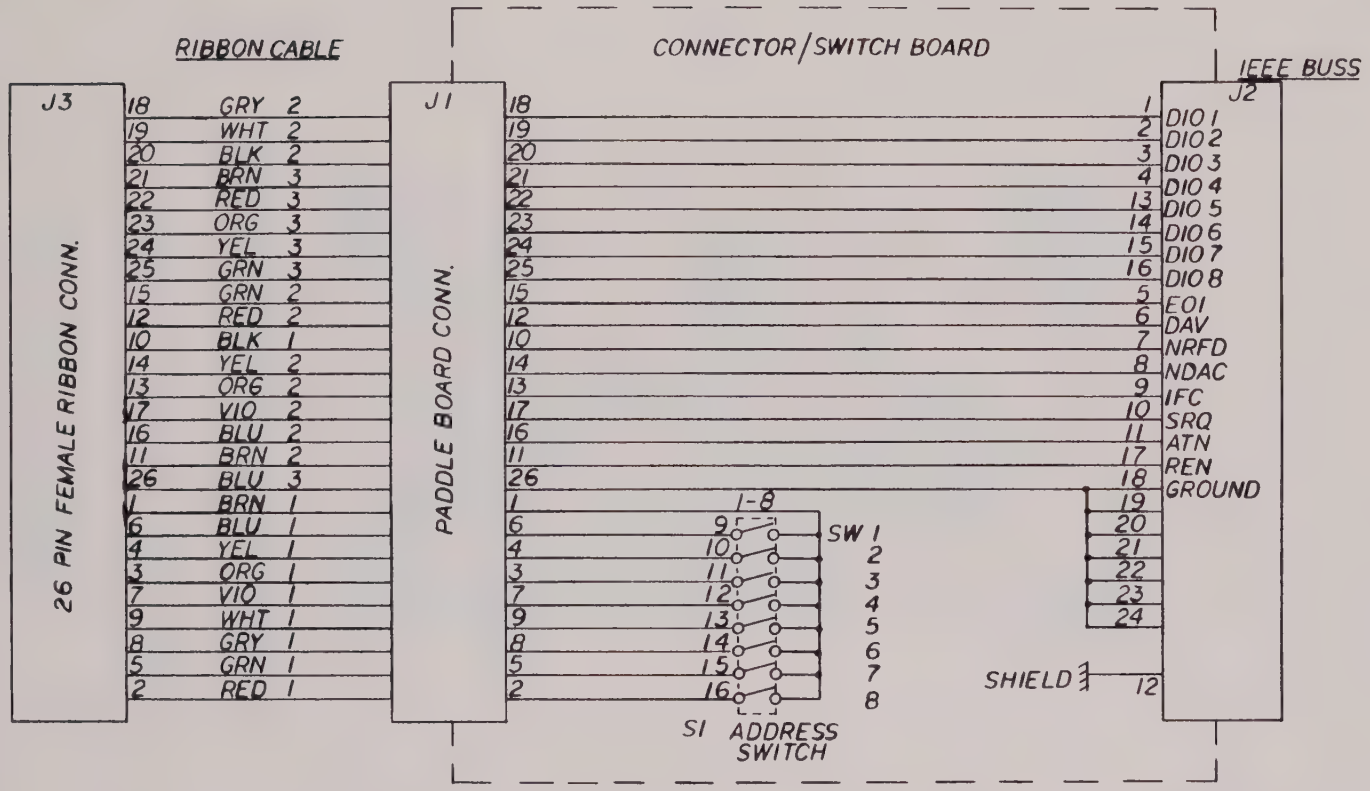

DWG NO | SH | REV

REVISIONS

REV	DESCRIPTION	DATE	APPROVED

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PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

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CONTRACT NO

APPROVALS	DATE
DRAWN RLH	7-27-82
CHECKED	
ISSUED	

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NEXT ASSY	USED ON
APPLICATION	

INTEGRA

488 PADDLE BOARD SCHEMATIC

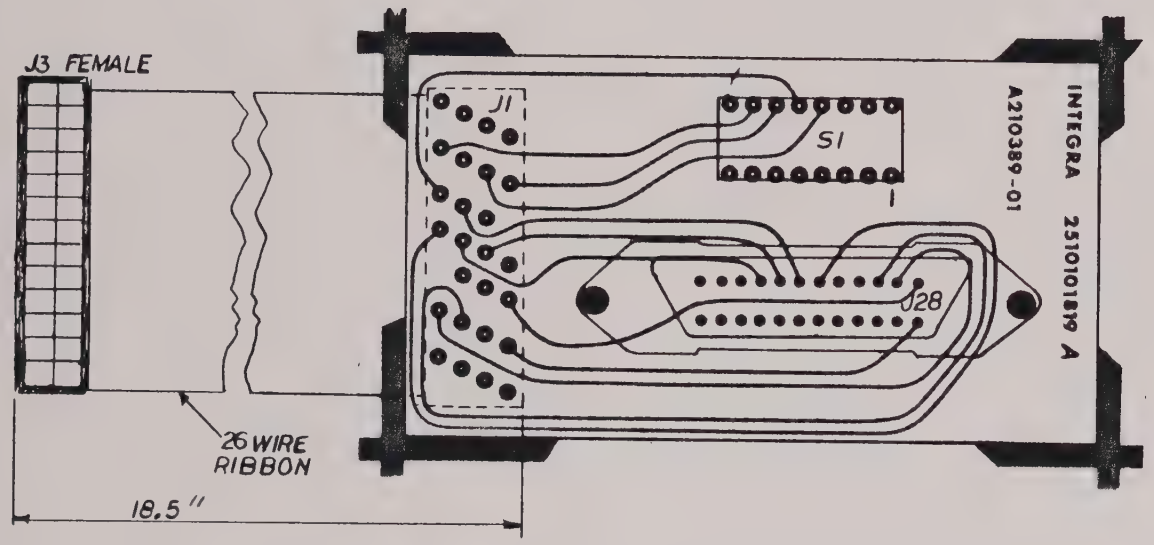
SIZE	FSCM NO.	DWG. NO.	REV.
B	51162	B110389-01	

SCALE | SHEET

BISHOP GRAPHICS INC
REORDER NO 20510

DWG. NO	SH	REV

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



QTY REQD	FSCM NO	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
PARTS LIST				

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	DWM-1800
	TMF-1800H
	TMF-1800K
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
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FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES °

MATERIAL —

FINISH —

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN RH	7-9-81
CHECKED Wm M L	7-9-81
ISSUED	
Wayne Schmidt	7-9-81

INTEGRA

CONNECTOR/SWITCH BOARD

SIZE	FSCM NO.	DWG. NO.	REV.
B	51162	B210389-01	A

SCALE 2~1 SHEET

BISHOP GRAPHICS, INC.
REORDER NO. 20510

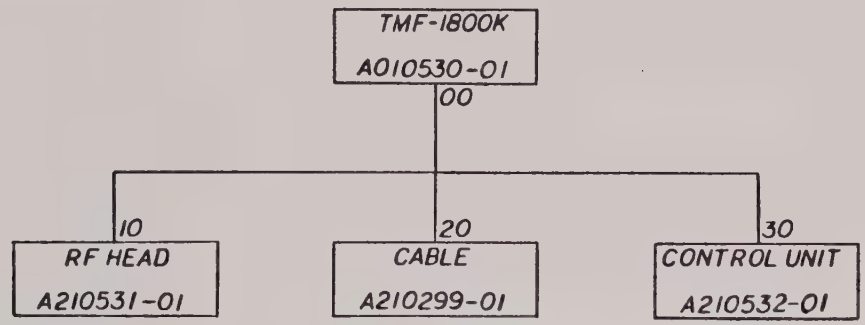
7.0 PARTS LIST

DWG. NO.	SH	REV.

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED

LEVEL 0

LEVEL 1



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PARTS LIST

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	S/N: 300 → UP
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL —

FINISH —

DO NOT SCALE DRAWING

CONTRACT NO

APPROVALS	DATE
DRAWN RCB	4-20-83
CHECKED	
ISSUED	

INTEGRA

PRODUCT STRUCTURE
TMF 1800K W/488 OPTION

SIZE	FSCM NO.	DWG. NO.	REV.
B	51162	B710530-01	

SCALE | SHEET

BISHOP GRAPHICS INC.
REORDER NO. 20510

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A010530-01
USED ON TMF-1800K
NEXT ASSEMBLY END ITEM
TITLE TMF-1800K

1 2 TC	DATE	7 CC	9 PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A0	10530-01			TMF-1800K	010	E	C	0026			00	0	END ITEM	5
		B6	10102299			MANUAL	010	E	7	0026			00	1	10530-01	5
		31	10100137			AC PWR CORD	010	E	7	0026			00	1	10530-01	5
		41	10101619			LABEL S/N	010	E	7	0026			00	1	10530-01	5
		54	10101711			SHIPPING CONTAINER	010	E	7	0026			00	1	10530-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210531-01
USED ON TMF-1800K
NEXT ASSEMBLY A010530-01
TITLE RF HEAD ASSEMBLY

1 2 TC	DATE	7 9 CC	PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A2	10531-01			RF HEAD ASSEMBLY	010	E	C	0026			10	1	10530-01	5
		A2	10329-04			YIG FILTER	010	E	S	0026			10	2	10531-01	5
		21	10100504			CONN SAVER	020	E	7	0026			10	2	10531-01	5
		31	10101673			WIRE, #24 ORG	050	I	7	0026			10	2	10531-01	5
		31	10101675			WIRE, #24 GRN	050	I	7	0026			10	2	10531-01	5
		31	10101676			WIRE, #24 BLU	050	I	7	0026			10	2	10531-01	5
		31	10101678			WIRE, #24 GRY	050	I	7	0026			10	2	10531-01	5
		31	10101679			WIRE, #24 WHT	050	I	7	0026			10	2	10531-01	5
		31	10101680			WIRE, #24 BLK	050	I	7	0026			10	2	10531-01	5
		31	10101681			WIRE, #24 RED	050	I	7	0026			10	2	10531-01	5
		41	10100236			WRAP, TIE	020	E	7	0026			10	2	10531-01	5
		41	10100520			CAN	010	E	7	0026			10	2	10102068	5
		41	10101381			CONN	010	E	7	0026			10	2	10531-01	5
		41	10101619			LABEL S/N	010	E	7	0026			10	2	10531-01	5
		41	10102094			RUBBER BUMPERS	040	E	7	0026			10	2	10531-01	5
		42	10004-03			SCREWS 4-40 X 3/8	040	E	7	0026			10	2	10531-01	5
		42	10102095			SCREWS 4-40 X 1/4	060	E	7	0026			10	2	10531-01	5
		52	10102069			LABEL PROD ID	010	E	7	0026			10	2	10531-01	5
		52	10102070			LABEL RF-INPUT	010	E	7	0026			10	2	10531-01	5
		52	10102112			LABEL RF-OUTPUT	010	E	7	0026			10	2	10531-01	5
		72	10102060			YIG HOLDER	010	E	7	0026			10	2	10531-01	5
		72	10102067			PLATE	010	E	7	0026			10	2	10531-01	5
		72	10102068			COVER, RF HEAD	010	E	2	0026			10	2	10531-01	5
		72	10100450			PLATE, LOCK	020	E	3	0026			10	2	10100450	5
		72	10100929			PLATE, ALUM	020	E	7	0026			10	2	10450-01	5

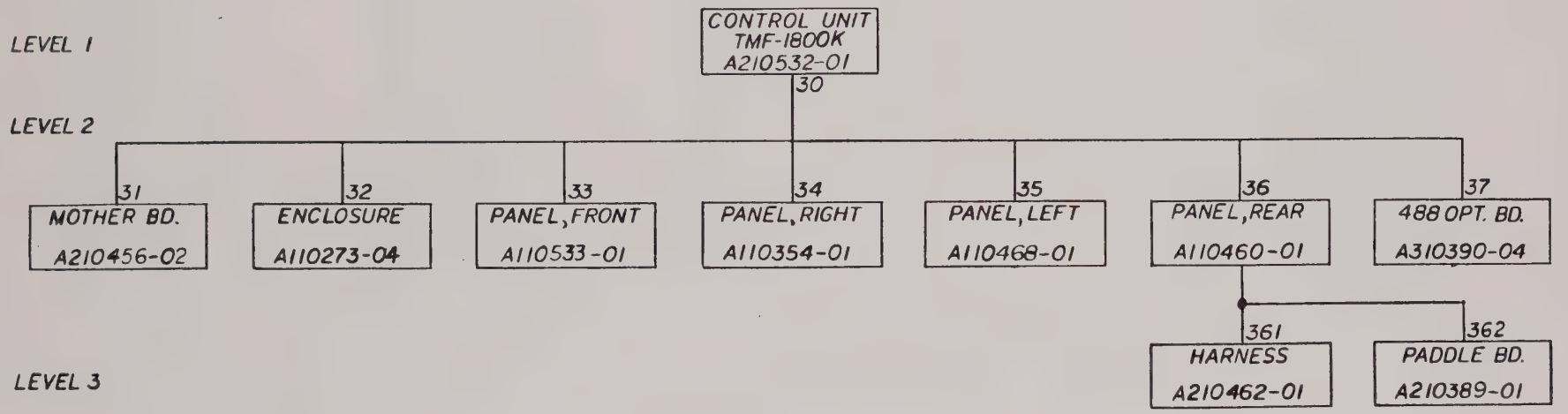
INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210299-01
USED ON TMF-1800K
NEXT ASSEMBLY A010530-01
TITLE CABLE, INTERCONNECT

1 2 TC	DATE	7 CC	9 PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A2	10299-01			CABLE, INTERCONNECT	010	E	C	0026			20	1	10530-01	5
		31	10101509			CABLE	050	F	7	0026			20	2	10299-01	5
		41	10101380			CONN	020	E	7	0026			20	2	10299-01	5

DWG NO.	SH	REV

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED



QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

	TMF-1800K
	SN: 300 → UP
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL —

FINISH —

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN RCB	4-20-83
CHECKED	
ISSUED	

INTEGRA

PRODUCT STRUCTURE
TMF-1800K WITH 488 OPT.

SIZE	FSCM NO.	DWG. NO.	REV.
B	51162	B710532-01	

SCALE | SHEET

BISHOP GRAPHICS, INC.
REORDER NO. 20510

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210532-01
USED ON TMF-1800K
NEXT ASSEMBLY A010530-01
TITLE TMF-CONTROL UNIT

1 2 TC	DATE	7 CC	9 PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A2	10532-01		A	CONTROL UNIT	010	E	C	0026			30	1	10530-01	5
		41	10100270			KNOB	020	E	7	0026			30	2	10532-01	5
		41	10100272			CAP	020	E	7	0026			30	2	10532-01	5
		41	10100278			WASHER, NYLON	080	E	9	0026			30	2	10532-01	5
		41	10100281			RETAINER, STRAP	040	E	9	0026			30	2	10101776	5
		41	10100283			FEET	040	E	9	0026			30	2	10532-01	5
		41	10100470			EXTRU, FRONT	020	E	9	0026			30	2	10532-01	5
		41	10101224			PANEL,DECORATIVE	020	E	9	0026			30	2	10532-01	5
		41	10101225			STRAP	020	E	9	0026			30	2	10532-01	5
		41	10101582			COVER, TOP	010	E	9	0026			30	2	10532-01	5
		41	10101583			COVER, BOTTOM	010	E	9	0026			30	2	10532-01	5
		41	10101776			RETAINER, STRAP	040	E	3	0026			30	2	10532-01	5
		42	10007-04			SCREW, #6-1/2	060	E	9	0034			30	2	10532-01	5
		42	10303-16			SCREW, #6-3/4, BLK	040	E	7	0026			30	2	10532-01	5
		42	10100277			SCREW, #6-3/4	080	E	9	0026			30	2	10532-01	5
		42	10100284			SCREW, #6-ST	050	E	9	0026			30	2	10532-01	5
		42	10100334			NUT, HEX #8	040	E	9	0026			30	2	10532-01	5
		42	10100335			SCREW, SPOTWELD	040	E	9	0026			30	2	10532-01	5
		42	10100337			SCREW, #8-1/2	040	E	9	0026			30	2	10532-01	5
		43	10100074			WASH, #6 FL	100	E	7	0034			30	2	10532-01	5
		43	10100075			WASH, #6 SPL	100	E	7	0034			30	2	10532-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210456-02 REV B
USED ON TMF-1800K WITH OPTION
NEXT ASSEMBLY A010532-01
TITLE MOTHER BOARD

1 2 TC DATE	7 9 CC PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
	A2 10456-02		B	MOTHER BD.	010	E	7	0034			31	2	10532-01	5
	13 10100434			C MICA 91 PF	010	E	7	0034	C 23		31	3	10456-02	5
	13 10100543			C CER .01uF	220	E	7	0034	C 1-4,6,7,9-14,22, 24,26,27,31-37		31	3	10456-02	5
	13 10100899			C SAT	020	E	7	0034	C 5,8		31	3	10456-02	5
	13 10101900			C ELECT 10uF 25V	040	E	7	0034	C 17,20,21,30		31	3	10456-02	5
	13 10101901			C ELECT, 1uF 50V	030	E	7	0034	C 16,19,29		31	3	10456-02	5
	13 10102164			CAP ELEC 4700uF	030	E	7	0034	C 15,18,28		31	3	10456-02	5
	15 10100016			DIODE 5.1V	020	E	7	0034	CR 33,34		31	3	10456-02	5
	15 10100019			DIODE IN4148	040	E	7	0034	CR 3,29,30,32		31	3	10456-02	5
	15 10100183			DIODE IN5240	010	E	7	0034	CR 22		31	3	10456-02	5
	15 10101137			DIODE IN6159	010	E	7	0034	CR 4		31	3	10456-02	5
	15 10101633			DIODE IN4004	190	E	7	0034	CR 5-16,19,23-28		31	3	10456-02	5
	17 10100382			LED, YEL	010	E	7	0034	CR 31		31	3	10456-02	5
	17 10100384			LED, GREEN	010	E	7	0034	CR 18		31	3	10456-02	5
	19 10100045			IC LIN	010	E	7	0034	VR 3		31	3	10456-02	5
	19 10100114			IC LIN LM741	020	E	7	0034	IC 6,11		31	3	10456-02	5
	19 10100116			IC LIN LM307	060	E	7	0034	IC 1-4,8,10		31	3	10456-02	5
	19 10100741			IC LIN REF-01	010	E	7	0034	IC 5		31	3	10456-02	5
	19 10101637			IC LIN +15V	010	E	7	0034	VR 1		31	3	10456-02	5
	19 10101638			IC LIN -15V	010	E	7	0034	VR 2		31	3	10456-02	5
	19 10101888			IC AD 533	010	E	7	0034	IC 9		31	3	10456-02	5
	19 10102052			DIODE TEMP	010	E	7	0034	CR 35		31	3	10456-02	5
	19 10102059			IC LM 344	010	E	7	0034	IC 7		31	3	10456-02	5
	25 10102054		B	PCB	010	E	7	0034			31	3	10456-02	5
	26 10100785			RELAY	020	E	7	0034	K 2,3		31	3	10456-02	5
	26 10101629			RELAY	010	E	7	0034	K 1		31	3	10456-02	5
	27 10100110			R CARB 10K	040	E	7	0034	R 73,74,83,87		31	3	10456-02	5
	27 10100190			R MF 100	020	E	7	0034	R 32,33		31	3	10456-02	5
	27 10100220			R MF 499	010	E	7	0034	R 8		31	3	10456-02	5
	27 10100286			R MF 20.0K	070	E	7	0034	R 9,34-37,57,58		31	3	10456-02	5
	27 10100288			R MF 14.7K	010	E	7	0034	R 20		31	3	10456-02	5
	27 10100289			R MF 10.0K	120	E	7	0034	R 29,51,67,69,90,92, 93,95,96,98,102,103		31	3	10456-02	5
	27 10100410			R CARB 10 MEG	010	E	7	0034	R 89		31	3	10456-02	5
	27 10100436			R MF 49.9K	050	E	7	0034	R 1,2,14,53,54		31	3	10456-02	5
	27 10100465			R CARB 1 OHM	010	E	7	0034	R 50		31	3	10456-02	5
	27 10100466			E WW 3 OHM 1% 25W	010	E	7	0034	R 31		31	3	10456-02	5
	27 10100583			R MF 301K	010	E	7	0034	R 19		31	3	10456-02	5
	27 10100585			R MF 39.2K	010	E	7	0034	R 40		31	3	10456-02	5
	27 10100599			R MF 100K	100	E	7	0034	R 28,65,75,77,82, 105,109-112		31	3	10456-02	5

1 2 TC	7 DATE	9 CC	PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		27	10100601			R MF 7.50K	030	E	7	0034	R 10,61,113		31	3	10456-02	5
		27	10100602			R MF 3.01K	020	E	7	0034	R 24,52		31	3	10456-02	5
		27	10100609			R MF 1.00 M	060	E	7	0034	R 38,39,56,81,70,71		31	3	10456-02	5
		27	10100610			R MF 1.00 K	080	E	7	0034	R 25-27,30,41,59,60,72		31	3	10456-02	5
		27	10100743			R CARB 510	010	E	7	0034	R 84		31	3	10456-02	5
		27	10100777			SAT	030	E	7	0034	R 21-23		31	3	10456-02	5
		27	10100820			R MF 200K	010	E	7	0034	R 18		31	3	10456-02	5
		27	10101018			R MF 499K	020	E	7	0034	R 66,104	31	3		10456-02	5
		27	10101033			R MF 13.7K	020	E	7	0034	R 63,107		31	3	10456-02	5
		27	10101088			R MF 19.1K	010	E	7	0034	R 116		31	3	10456-02	5
		27	10101132			R MF 3.92K	010	E	7	0034	R 85,86		31	3	10456-02	5
		27	10101271			R MF 26.1K	010	E	7	0034	R 6		31	3	10456-02	5
		27	10101274			R MF 51.1K	010	E	7	0034	R 5		31	3	10456-02	5
		27	10101278			R MF 1.96K	010	E	7	0034	R 7		31	3	10456-02	5
		27	10101385			R MF 20.0K .1%	070	E	7	0034	R 13,16,42,43,76, 78,114		31	3	10456-02	5
		27	10101528			R MF 18.2K	020	E	7	0034	R 62,108		31	3	10456-02	5
		27	10101636			R MF 732K	010	E	7	0034	R 79		31	3	10456-02	5
		27	10101877			R CARB 2.4M	020	E	7	0034	R 99,100		31	3	10456-02	5
		27	10102080			R MF 402K	010	E	7	0034	R 17		31	3	10456-02	5
		27	10102081			R MF 604K	010	E	7	0034	R 12		31	3	10456-02	5
		27	10102083			R MF 909K	010	E	7	0034	R 39		31	3	10456-02	5
		27	10102173			R CARB 2M	010	E	7	0034	R 80		31	3	10456-02	5
		28	10100010			R VAR 10K, 10T	020	E	7	0034	R 11,15		31	3	10456-02	5
		28	10101960			R VAR 1K	010	E	7	0034	R 4		31	3	10456-02	5
		28	10101961			R VAR 2K	020	E	7	0034	R 3,117		31	3	10456-02	5
		28	10101962			R VAR 10K	070	E	7	0034	R 44,45,55,64,88, 106,115		31	3	10456-02	5
		28	10101963			R VAR 20K	050	E	7	0034	R 68,91,94,97,101		31	3	10456-02	5
		28	10101964			R VAR 100K	040	E	7	0034	R 46-49		31	3	10456-02	5
		30	10100092			TRANSISTOR NPN	010	E	7	0034	Q 5		31	3	10456-02	5
		30	10100196			TRANS, 2N5401	020	E	7	0034	Q 1,2		31	3	10456-02	5
		30	10100233			TRANS, MM4001	010	E	7	0034	Q 3		31	3	10456-02	5
		30	10100237			TRANS, 2N6228	010	E	7	0034	Q 4		31	3	10456-02	5
		41	10100084			SOCKET 14 PIN	010	E	7	0034			31	3	10456-02	5
		41	10100124			SOCKET 8 PIN	010	E	7	0034			31	3	10456-02	5
		41	10100128			SOCKET 16 PIN	070	E	7	0034			31	3	10456-02	5
		41	10100239			HEATSINK	010	E	7	0034	H 1		31	3	10456-02	5
		41	10101093			SWITCH POWER	010	E	7	0034	S 1		31	3	10456-02	5
		41	10101552			S DIP	010	E	7	0034	S 6		31	3	10456-02	5
		41	10101622			POST HEADER FRICTION LK	010	E	7	0034	J 1		31	3	10456-02	5
		41	10101624			POST HEADER FRICTION LK	010	E	7	0034	J 8		31	3	10456-02	5
		41	10101626			CONNECTOR	010	E	7	0034	J 7		31	3	10456-02	*5
		41	10101631			DIP PLUG, 16 PIN	010	E	7	0034			31	3	10456-02	5

1 2 TC	DATE	7 CC	9 PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		41	10101852			S DIP	010	E	7	0034	S 1		31	3	10456-02	5
		41	10102074			POST HEADER FRICTION LK	010	E	7	0034	J 9		31	3	10456-02	5
		42	10004-02			SCREW 4-40 1/4	020	E	7	0034			31	3	10456-02	5
		42	10004-03			SCREW 4-40 3/8	050	E	7	0034			31	3	10456-02	5
		42	10218-04			SCREW 6-32 1/2	020	E	7	0034			31	3	10456-02	5
		42	10100070			NUT #6	040	E	7	0034			31	3	10456-02	5
		42	10100175			NUT #4	020	E	7	0034			31	3	10456-02	5
		42	10101657			SPACER	060	E	7	0034			31	3	10456-02	5
		42	10218-06				020	E	7	0034			31	3	10456-02	5
		43	10100074			WASHER FLAT	050	E	7	0034			31	3	10456-02	5
		43	10100075			WASHER SPLIT	060	E	7	0034			31	3	10456-02	5
		43	10100179			WASHER FLAT	060	E	7	0034			31	3	10456-02	5
		43	10100180			WASHER SPLIT	050	E	7	0034			31	3	10456-02	5
		43	10100188			INSULATOR	010	E	7	0034			31	3	10456-02	5
		50	10102143			FISH PAPER	230	I	7	0034			31	3	10102085	5
		52	10101974			MYLAR TAPE	030	I	7	0034	TP 1		31	3	10456-02	5
		72	10101579			BRACKET PC MOUNT	060	E	7	0034	B 3-8		31	3	10456-02	5
		72	10102055			PANEL SUB	010	E	7	0034	B 1		31	3	10456-02	5
		72	10102166			BRACKET, HEATSINK	010	E	7	0034	B 2		31	3	10456-02	5
		72	10102170			BRACKET HEATSINK	010	E	7	0034			31	3	10102166	5
		73	10102085			PROT COVER, AC POWER	010	E	3	0034			31	3	10456-02	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A110273-04
USED ON TMF-1800K
NEXT ASSEMBLY A210532-01
TITLE ENCLOSURE

1 2 TC	DATE	7 9 CC	PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A1	10273-04			ENCLOSURE	010	E	7	0026			32	2	10532-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A110533-01
USED ON TMF-1800K
NEXT ASSEMBLY A110532-01
TITLE PANEL FRONT

1 2 TC	7 DATE	9 CC	PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A1	10533-01		A	PANEL, FRONT	010	E	C	0026			33	2	10532-01	5
		41	10100901			ALUM, BLK	500	C	7	0026			33	2	10102062	5
		72	10102057			PANEL, FRONT	010	E	7	0026			33	3	10533-01	5
		72	10102300			LABEL, FRONT PANEL	010	E	3	0026			33	3	10533-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A110354-01
USED ON TMF-1800K
NEXT ASSEMBLY A210532-01
TITLE PANEL, SIDE RIGHT

1 2 TC	DATE	7 9 CC	PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A1	10354-01		A	PANEL, SIDE RT	010	E	C	0026			34	2	10532-01	5
		41	10100326			CAST, CNR FR	010	E	9	0026			34	3	10354-01	5
		41	10100327			CAST, CNR RE	010	E	9	0026			34	3	10354-01	5
		41	10101062			EXTRU, SIDE	020	E	9	0026			34	3	10354-01	5
		41	10101226			PLATE, STRU SID	010	E	9	0026			34	3	10101591	5
		41	10101591		A	PANEL, SIDE RIGHT	010	E	3	0026			34	3	10354-01	5
		42	10100332			NUT, CLIP	040	E	9	0026			34	3	10354-01	5
		42	10100333			NUT, CLIP	040	E	9	0026			34	3	10354-01	5
		42	10100334			NUT, HEX #8	040	E	9	0026			34	3	10354-01	5
		42	10100335			SCREW, SPOTWELD	040	E	9	0026			34	3	10354-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A110468-01
USED ON TMF-1800K
NEXT ASSEMBLY A210532-01
TITLE PANEL, SIDE LEFT

1 2 TC	7 9 DATE CC	PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
	A1	10468-01		A	PANEL, SIDE LF	010	E	C	0026			35	2	10532-01	5
	29	10101617			TRANSFORMER	010	E	7	0026			35	2	10468-01	5
	41	10100326			CAST,CNR FR	010	E	9	0026			35	3	10468-01	5
	41	10100327			CAST,CNR RE	010	E	9	0026			35	3	10468-01	5
	41	10101062			EXTRU,SIDE	020	E	9	0026			35	3	10468-01	5
	41	10101226			PLATE,STRU SID	010	E	9	0026			35	3	10101592	5
	41	10101592		C	PANEL, SID LF	010	E	3	0026			35	3	10468-01	5
	42	10007-04			SCREW, #6-1/2	040	E	7	0034			35	3	10468-01	5
	42	10100332			NUT, CLIP	040	E	9	0026			35	3	10468-01	5
	42	10100333			NUT, CLIP	040	E	9	0026			35	3	10468-01	5
	42	10100334			NUT, HEX #8	040	E	9	0026			35	3	10468-01	5
	42	10100335			SCREW, SPOTWELD	040	E	9	0026			35	3	10468-01	5
	43	10100074			WASH, #6 FL	040	E	7	0034			35	3	10468-01	5
	43	10100075			WASH, #6 SPL	040	E	7	0034			35	3	10468-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A110460-01
USED ON TMF-1800K
NEXT ASSEMBLY A110532-01
TITLE PANEL REAR

1 2 TC	DATE	7 CC	9 PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A1	10460-01		A	PANEL, REAR	010	E	C	0026		36	2		10532-01	5
		16	10100502			FUSE, 1 AMP SB	010	E	7	0026		36	3		10460-01	5
		41	10100125			BNC	020	E	7	0026		36	3		10460-01	5
		41	10100901			ALUM, BLK	500	C	7	0026		36	3		10460-01	5
		41	10101087			RECEPT, A/C	010	E	7	0026		36	3		10460-01	5
		41	10101118			SWITCH, TOGGLE	010	E	7	0026		36	3		10460-01	5
		41	10101381			CONN	010	E	7	0026		36	3		10460-01	5
		72	10102056			PANEL, REAR	010	E	7	0026		36	3		10460-01	5
		72	10102061			LABEL, REAR PANEL	010	E	3	0026		36	3		10460-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210462-01
USED ON TMF-1800K
NEXT ASSEMBLY A110460-01
TITLE HARNESS

1 2 TC DATE	7 9 CC PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
	A2 10462-01		A	HARNESS	010	E	6	0026			361	3	10460-01	5
	31 10100262			WIRE, #20 RED	030	F	7	0026			361	4	10462-01	5
	31 10100263			WIRE, #20 BLU	030	F	7	0026			361	4	10462-01	5
	31 10101672			WIRE, #24 BRN	020	F	7	0026			361	4	10462-01	5
	31 10101674			WIRE, #24 YEL	020	F	7	0026			361	4	10462-01	5
	31 10101675			WIRE, #24 ORG	020	F	7	0026			361	4	10462-01	5
	31 10101676			WIRE, #24 BLU	020	F	7	0026			361	4	10462-01	5
	31 10101677			WIRE, #24 VIO	010	F	7	0026			361	4	10462-01	5
	31 10101678			WIRE, #24 GRY	010	F	7	0026			361	4	10462-01	5
	31 10101679			WIRE, #24 WHT	010	F	7	0026			361	4	10462-01	5
	31 10101680			WIRE, #24 BLK	020	F	7	0026			361	4	10462-01	5
	31 10101681			WIRE, #24 RED	020	F	7	0026			361	4	10462-01	5
	41 10100236			WRAP, TIE	500	E	7	0026			361	4	10462-01	5
	41 10101621			CONN	010	E	7	0026			361	4	10462-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210389-01
USED ON TMF-1800K
NEXT ASSEMBLY A110460-01
TITLE 488 PADDLE BOARD

1 2 TC	DATE	7 9 CC	PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A2	10389-01			CONN SWITCH BD	010	E	C	0001			362	3	10460-01	5
		25	10101819			PCB	010	E	7	0001			362	4	10389-01	5
		31	10101813			RIBBON CABLE	190	I	7	0001			362	4	10389-01	5
		41	10101149			STANDOFF KIT	010	E	7	0001			362	4	10389-01	5
		41	10101816			CONN, 26 PIN FEMALE	010	E	7	0001			362	4	10389-01	5
		41	10101817			488 CONNECTOR	010	E	7	0001			362	4	10389-01	5
		41	10101814			PADDLE BD CONN	010	E	7	0001			362	4	10389-01	5
		41	10101852			SWITCH	010	E	7	0001			362	4	10389-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210390-04
USED ON TMF-1800K REV B
NEXT ASSEMBLY STOCK
TITLE IEEE 488 INTERFACE BOARD

1 2 TC	DATE	7 9 CC	PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
A2		10	10390-04		B	IEEE 488 INT BD	010	E	C	0008			37	2	STOCK	5
13		10	10100088			C CER 0.01 UF	090	E	7	0008	C 1,3,4,6,16-20		37	3	10390-04	5
13		10	10100968			C MICA 24 PF	020	E	7	0008	C 21, 22		37	3	10390-04	5
13		10	10101900			C ELEC 10 UF	040	E	7	0008	C 2,5,7,23		37	3	10390-04	5
13		10	10101936			C ELEC 4.7 UF	020	E	7	0008	C 14,15		37	3	10390-04	5
14		10	10101958			CRYSTAL, 11.0596MHZ	010	E	7	0008	Y 1		37	3	10390-04	5
15		10	10100019			DIODE	010	E	7	0008	CR 11		37	3	10390-04	5
15		10	10101633			DIODE, 1N4004	040	E	7	0008	CR 3,4,5,12		37	3	10390-04	5
17		10	10100382			LED, RED	040	E	7	0008	CR 7-10		37	3	10390-04	5
19		10	10101109			IC, DAC-71-CCD-V	010	E	7	0008	IC 1		37	3	10390-04	5
19		10	10101891			IC, SN74LS00N	010	E	7	0008	IC 6		37	3	10390-04	5
19		10	10101933			IC, 74LS138	010	E	7	0008	IC 7		37	3	10390-04	5
19		10	10101934			IC, 75161	010	E	7	0008	IC 19		37	3	10390-04	5
19		10	10101935			IC, 75160	010	E	7	0008	IC 20		37	3	10390-04	5
19		10	10101939			IC, 8039-L	010	E	7	0008	IC 8		37	3	10390-04	5
19		10	10101940			IC, 74LS373	010	E	7	0008	IC 18		37	3	10390-04	5
19		10	10101941			IC, 2716	010	E	7	0008			37	3	10435-01	5
19		10	10101942			IC, TMS9914NL	010	E	7	0008	IC 16		37	3	10390-04	5
19		10	10101943			IC, 74LS86	010	E	7	0008	IC 15		37	3	10390-04	5
19		10	10101944			IC, 74LS74	010	E	7	0008	IC 14		37	3	10390-04	5
19		10	10101945			IC, 8243	030	E	7	0008	IC 9,10,13		37	3	10390-04	5
19		10	10435-01			IC, PROM 8K	010	E	3	0008	IC 17		37	3	10390-04	5
25		10	10101837		A	PCB	010	E	7	0008			37	3	10390-04	5
27		10	10100110			R CARB 10K	090	E	7	0008	R 5,6,11-14		37	3	10390-04	5
27		10	10100225			R CARB 33K	010	E	7	0008	R 27		37	3	10390-04	5
27		10	10100303			R CARB 510K	010	E	7	0008	R 1		37	3	10390-04	5
27		10	10100304			R CARB 1K	010	E	7	0008	R 28		37	3	10390-04	5
27		10	10100411			R CARB 3.3M	010	E	7	0008	R 3		37	3	10390-04	5
27		10	10101937			R CARB 160	040	E	7	0008	R 29-32		37	3	10390-04	5
27		10	10101938			R SIP 33K	010	E	7	0008	RP 1		37	3	10390-04	5
28		10	10100321			R VAR 50K	020	E	7	0008	R 2,4		37	3	10390-04	5
30		10	10100095			TRANS, 2N4126	030	E	7	0008	Q 1,3,4		37	3	10390-04	5
31		10	10101675			WIRE, 24 AWG GRN	080	I	7	0008			37	3	10390-04	5
31		10	10101680			WIRE, 24 AWG BLK	080	I	7	0008			37	3	10390-04	5
41		10	10100084			SOCKET, 14 PIN	030	E	7	0008			37	3	10390-04	5
41		10	10100085			SOCKET, 40	020	E	7	0008			37	3	10390-04	5
41		10	10100128			SOCKET, 16 PIN	010	E	7	0008			37	3	10390-04	5
41		10	10100131			SOCKET, 24 PIN	050	E	7	0008			37	3	10390-04	5
41		10	10101809			TERMINAL	020	E	7	0008	TP 1,2		37	3	10390-04	5
41		10	10101122			SOCKET, 20 PIN	030	E	7	0008			37	3	10390-04	5
41		10	10101623			CONN, 2 PIN	020	E	7	0008			37	3	10390-04	5
41		10	10101624			CONN, 2 PIN	010	E	7	0008	J 4		37	3	10390-04	5
41		10	10101625			CONN, 16 PIN	010	E	7	0008	J 2		37	3	10390-04	5
41		10	10101815			CONN, 26 PIN	010	E	7	0008	J 3		37	3	10390-04	5

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